AGS (HK) Report Submission on

Technical Seminar on State-of-the-art Deep Mixing Practice for Land Reclamation in Hong Kong by Anthony H. K. WONG

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On 22 September 2022, Mr. Anthony Wong gave a presentation on non-dredged reclamation with Deep Cement Mixing (DCM). Followed by the introduction of fundamentals of DCM, he provided insight into the typical design flow, results of laboratory trial mix, construction quality management procedures and ways to improve field tests.

DCM has three main ingredients; binder, in-situ soil and water. The binder is formed by cement, the in-situ soil refers to the Marine Deposits (MD) or Alluvium underneath the seabed, while the water comes from both in-situ soil and binder slurry. The strength of treated soft ground is increased by a hydration reaction between the binder and water. Several types of DCM includes column, wall, grid and block that can be used depending on the required rigidity of the reclaimed land. Several factors can influence the strength of DCM, which are binder characteristics, characteristics and conditions of soil, mixing and curing conditions.

A typical design flow of deep mixing has six steps. For instance, desk study and site investigation, establishing design strength and treatment geometry, laboratory mixing tests, field trials, construction of trial embankment, and quality check.

A comprehensive quality control/quality assurance system is essential to the success of deep mixing. Samples of binder and binder slurry need to be tested regularly to evaluate the properties and water-to-binder ratio to achieve the standards. The density test of binder slurry can be measured using mud balance, and the results can be obtained easily and quickly on site. The DCM plant should be calibrated every three months. A cycle diagram is used to check whether the operational parameters have any deviations. The quality of the completed columns will be verified by DCM coring and testing.

The laboratory trial mix presented suggests some trends of distinct factors influencing the properties of DCM. Test results depict that MD slurry mix of PBFC binder, the components of Ordinary Portland Cement (OPC) and Ground Granulated Blast-furnace Slag (GGBS), demonstrates higher strength than the MD slurry mix solely with OPC binder. The higher the dosage of binder used, the higher the strength of the mix. The total water content in the mix is another major affecting factor to strength. In comparison with the mixes in alluvial layer, those in MD generally have lower strength because of the higher water

content. Water reduces the overall strength of the mixes. Besides, the strength of the DCM specimens increases with curing time.

A series of laboratory tests are performed to examine the material engineering properties of DCM. It is worth looking into the possible ways of simplifying certain standards of the testing methods. There are studies for examples to find the correlation factor (K) between the uniaxial compression strength and point load index test and to investigate the feasibility of using smaller diameter cores in verification testing.

Although DCM is relatively new in Hong Kong, it is common in Japan, South Korea and United States. The recent projects of DCM method in Third Runway and Tung Chung New Town can help pave the way for future development of the technique in local market.