Filling Management for Development of the Special Economic Zone in Bangladesh

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1. Introduction

In order to develop a Special Economic Zone mainly targeting Japanese investors and to further facilitate investments from Japan, the government of Bangladesh has requested the government of Japan to provide a Japanese loan for the development of Japanese special economic zone, and its agreement was made in December 2015. From the viewpoint of Engineering, this paper presents with respect of the filling management of the land development work commenced in August 2020 which is one of the several packages in the Project.

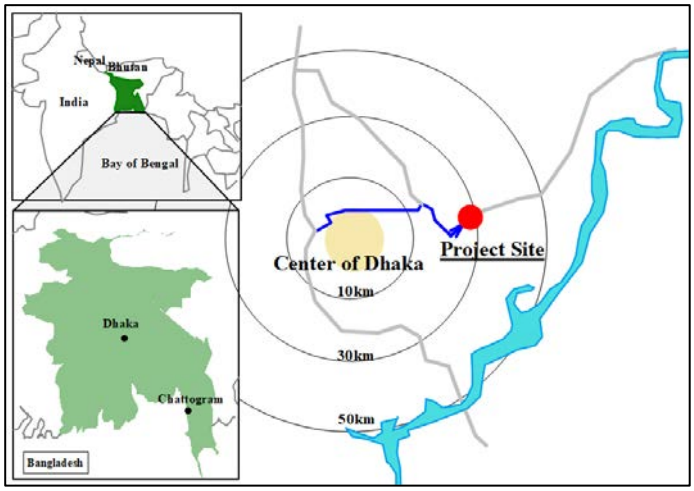

Figure 1 Location of the Project

2. Features

Figure 1 shows the location of the Project where is about 25km in the east-northeast of the capital city of Dhaka. The land development work consists of the following:

1) Land reclamation work up to MSL +6.5m of the final ground level from MSL +2.5m to MSL +3.0m of the existing ground level. The reclamation area is approximately 200ha, and the surrounding is made by the embankment to MSL +8.0m, 2) Access Road Construction about 325m in length to be connected from the National Highway No.2 to the Project Area, 3) Construction of Retention Canal with 710m in length, Retention Pond of 8.6ha with 211,00m^3 in storage capacity, Pump Station with 6.3m^3/s of pump capacity and Sluice Gates with 2.0 m wide x 1.5 m high x 3 barrels.

3. Filling Material Characteristics

Material for land filling work is dredged from the riverbed of the Meghna/Padoma River is carried by barges to its branch dock about 65km in the north-northeast of the dredged area. Afterward, it is transported to the Project Area approximately 8km away by 10 pipes and booster pumps laying on the ground.

Table 1 describes the physical and mechanical properties of filling material for the land filling work. According to the Japanese Unified Soil Classification, it is classified as Sand with over 90% of fine sand, 1.5~2.3 of coefficient of uniformity and 1.0~1.2 of coefficient of curvature. The filling material has 2.65~2.66 of the specific gravity and 14.1kN/m^3~15.3kN/m^3 of the maximum dry density with 12%~24% of the optimum water content. Besides, it is probably that mica is contained in the filling material since luster particles are observed.

Table 1 Geotechnical Characteristics of Filling Material

Specific Gravity		2.65 - 2.66
Maximum Dry Density (kN/m^3)		14.1 - 15.3
Optimum Water Content (%)		12.0 - 24.0
Particle Size Distribution	< 0.074mm (%)	0.1 - 5.3
	0.074mm-0.425mm(%)	92.3 - 99.7
	> 0.425mm(%)	0.1 - 3.3

4. Filling Management

The ground of the project area consists of three layers as silty soil of 10m to 14m in thickness, clayey soil of 6m to

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28m in thickness and sandy soil in order from the ground surface as described in Figure 2. Especially, the clayey soil with the compression index of 0.32 to 0.86 (referred to as Layer 2) has large consolidation settlement due to filling. In area where large consolidation settlement exceeding 800mm is expected, the PVD method is applied to the soil improvement to accelerate the settlement. Therefore, it is essential to always manage the analysis and monitoring of the data from the project site in order to comprehend the applicable filling volume and the ground level at the time for taking over.

Figure 3 illustrates the filling method and its management. Filling material with water are deposited and spread by pumping through the pipelines to the project area and compacted by hydraulic fill method. The degree of compaction of filling material is required to exceed over 85% of the maximum dry density. In order to manage the degree of compaction for the wide area, cone penetration test (CPT) correlated with dry density was conducted. For compaction at thickness in 150mm from the ground level at the taking over, mechanical compaction is used to achieve the requirement of over 90% of the maximum dry density and confirmed by field density test (FDT).

As an instance, Figure 4 shows the dry density results obtained from 353 locations of the field. The results show that all measurement values meet the requirement, and also over 57% of them are between 15kN/m^3 and 16kN/m^3

5. Summary and Acknowledgements

The outline of the project and filling management were introduced. It was also shown that CPT and FDT is practical for filling management of wide area.

We would like to sincerely appreciate Bangladesh Economic Zone Authority of the project executing authority for kind understanding and cooperation of preparation of this paper.

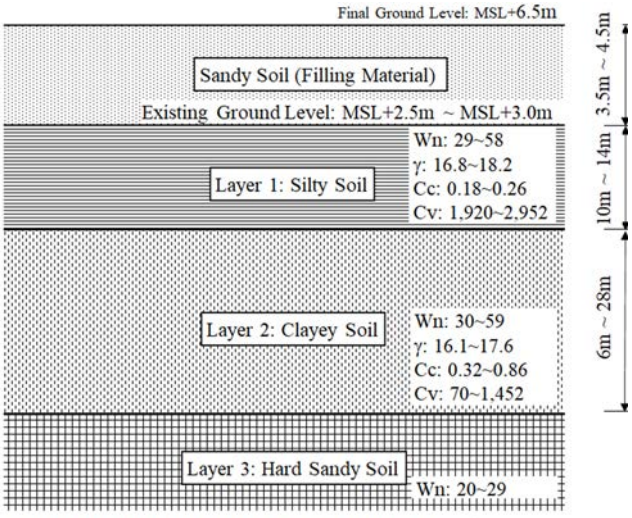

Figure 2 Soil Characteristics of Existing Ground Deposits

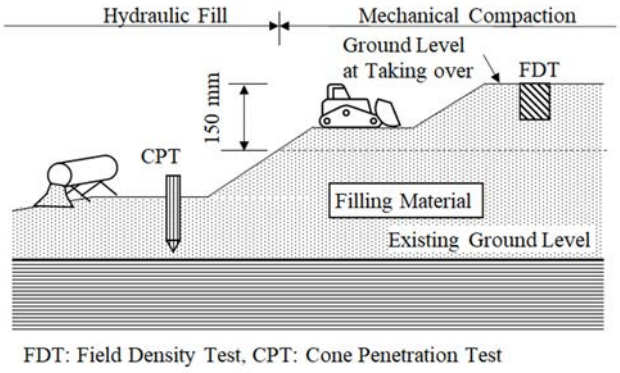

Figure 3 Process of Filling and its Management

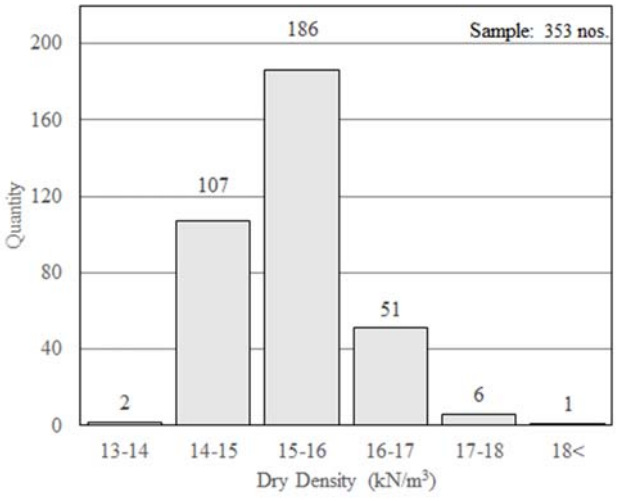

Figure 4 Distribution of Dry Density of Filling Material