

測試香港土壤的方法 (GEOSPEC 3 Model Specification for Soil Testing)

引言

本作業備考公布採納一套香港土壤測試標準 – “Geospec 3”，以配合香港的實際情況。該標準是因應業界對一套全面的香港土壤測試標準的需求而制定的。它涵蓋了附錄A所列的土壤分類及壓實測試（“擴編第一階段土壤測試” – 共32項），以及附錄B所列的土壤抗剪強度及壓縮性測試（“第二階段土壤測試” – 共7項）。由土木工程拓展署轄下的土力工程處出版的“Geospec 3 – Model Specification for Soil Testing”，可於網上政府書店 (<http://bookstore.esdlife.com>) 購買。

背景

2. 1992年，為了制定一系列的香港土壤測試標準，土力工程處以英國標準 BS1377:1990 – “Methods of Test for Soils for Civil Engineering Purposes” 為基礎，進行檢討土壤測試的標準。第一階段的檢討涵蓋土壤分類及壓實測試。土力工程處第36號報告 – “Methods of Test for Soils in Hong Kong for Civil Engineering Purposes (Phase I Tests)” 輯錄了檢討的結果，即建議訂出新的測試標準。1994年9月首次發出的《認可人士及註冊結構工程師作業備考》167，介紹該報告的新訂標準。第二階段的檢討包括土壤抗剪強度及壓縮性測試（“第二階段土壤測試”），同時也包括第一階段的土壤測試及額外的同類測試（“擴編第一階段土壤測試”）。現時的“Geospec 3”輯錄了32項擴編第一階段土壤測試的標準方法，以及7項第二階段土壤測試的標準方法。

圖則或施工同意書申請的審批

3. 認可人士、註冊結構工程師及註冊岩土工程師就建築物發展項目的勘測、設計及建造訂出相關的土壤測試時，應採用“Geospec 3”作為標準。任何提交涉及土壤測試的測試報告，無

論該報告是提交作為申請審批圖則的證明文件，或是作為符合按《建築物條例》第17(1)條第6(b)款施加於批准或開工同意書的條件，倘若土壤測試沒有遵從“Geospec 3”的要求進行，建築事務監督可拒絕批准圖則或發出施工同意書。若土壤測試偏離“Geospec 3”的標準，建築事務監督亦可拒絕批准在《建築物條例》附表所列地區內的土地勘測圖則、地盤平整圖則或任何其他含有岩土工程成分的圖則。同樣地，如填土物料的原位密度測試及實驗所壓實測試沒有依據“Geospec 3”的標準進行，填土工程的竣工證明書可能不被接受（請參閱《認可人士及註冊結構工程師作業備考》55）。

實驗所的選擇

4. 如須進行土壤測試，只可委託香港實驗所認可計劃（以下簡稱為‘認可計劃’）認可的實驗所進行有關測試。建築事務監督只接受由認可計劃簽發的測試證書或報告。因此，認可人士／註冊結構工程師／註冊岩土工程師應確保受委託的實驗所已通過香港認可處的審核，有資格進行有關測試，並獲授權簽發認可計劃認許的測試證書或報告。香港認可處每年均出版一冊《認可實驗所目錄》（認可計劃009）列出所有於認可計劃下認可進行各種測試項目的實驗所。透過創新科技署品質事務部（電話：2829 4840），或香港認可處網頁（<http://www.info.gov.hk/itc/hkas>），可獲得最新的實驗所名冊及其可進行測試項目的資料。“Geospec 3”第2.3條載述有關選擇實驗所的指引。

土壤測試數據的可信性

5. 土壤測試數據為建築發展項目的擬議勘測、設計及建造提供依據，而建築事務監督對於土壤測試數據的代表性及準確性，極為重視。因此，建築事務監督會嚴肅對待測試資料的可信度。如有人在呈交文件時故意誤報重要資料，建築事務監督會考慮拒絕批准圖則，並加以制裁。為協助認可人士、註冊結構工程師及註冊岩土工程師，特提供以下實用指引：

- 根據地盤的地質情況小心擬備測試進度表，並且根據“Geospec 3”的指引為每個測試項目提供有關資料，包括土壤類型的資料；
- 適當地監督取樣、貯存和運輸樣本，以及製備測試樣本，以免樣本受到擾動，並確保樣本安全；
- 應小心進行測試，並妥為記錄及貯存測試結果；在適當時，對測試結果進行分析和覆核；及
- 如須複印認可計劃認許的測試報告，應全篇複印。如對此類呈交予建築事務監督的報告有任何疑問，應向香港認可處澄清。

符合“Geospec 3”標準的認可實驗室

6. 對於2004年7月1日或以後進行的土壤測試，建築事務監督只接受認可計劃認許的土壤測試證書，或由香港認可處認證可根據“Geospec 3”進行有關測試的實驗室發出的測試報告。

土力工程處報告第36號中的第一階段土壤測試

7. 任何於2004年7月1日前進行的土壤測試，建築事務監督仍會接受認可計劃認許的測試證書，或根據土力工程處第36號報告所作的¹第一階段土壤測試報告(見附錄C)。同時，建築事務監督也接受認可計劃認許的測試證書，或根據“Geospec 3”進行的²第一階段土壤測試報告，作為等效的測試證書／報告。

建築事務監督張孝威

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編入索引：土壤測試

附錄 A
(認可人士及註冊結構工程師作業備考 167)
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“Geospec 3”擴編第一階段土壤測試的測試標準

標準方法	特定測試
Geospec 3 – Test Method 5.1	Determination of Moisture Content by Oven-drying at $45 \pm 5^{\circ}\text{C}$
Geospec 3 – Test Method 5.2	Determination of Moisture Content by Oven-drying at $105 \pm 5^{\circ}\text{C}$
Geospec 3 – Test Method 5.3	Comparative Test for the Determination of Moisture Content by Oven-drying
Geospec 3 – Test Method 6.1	Determination of Liquid Limit, Plastic Limit and Plasticity Index
Geospec 3 – Test Method 6.2	Determination of Liquidity Index
Geospec 3 – Test Method 7.1	Determination of Particle Density by Gas Jar Method
Geospec 3 – Test Method 7.2	Determination of Particle Density by Small Pyknometer Method
Geospec 3 – Test Method 8.1	Determination of Particle Size Distribution by Wet Sieving (with Dispersant)
Geospec 3 – Test Method 8.2	Determination of Particle Size Distribution by Wet Sieving (without Dispersant)
Geospec 3 – Test Method 8.3	Determination of Particle Size Distribution by the Pipette Method (with Dispersant)
Geospec 3 – Test Method 8.4	Determination of Particle Size Distribution by the Pipette Method (without Dispersant)
Geospec 3 – Test Method 8.5	Determination of Particle Size Distribution by the Hydrometer Method (with Dispersant)
Geospec 3 – Test Method 8.6	Determination of Particle Size Distribution by the Hydrometer Method (without Dispersant)
Geospec 3 – Test Method 8.7	Construction of a Continuous Particle Size Distribution Curve from the Results of Wet Sieving and Sedimentation Tests
Geospec 3 – Test Method 9.1	Determination of Organic Matter Content
Geospec 3 – Test Method 9.2	Determination of the Mass Loss on Ignition
Geospec 3 – Test Method 9.3	Determination of Total Sulphate Content of Soils and Sulphate Content of Groundwater and of Aqueous Soil Extracts by Gravimetric Method
Geospec 3 – Test Method 9.4	Determination of Water-soluble Chloride Content
Geospec 3 – Test Method 9.5	Determination of the pH Value

“Geospec 3” 擴編第一階段土壤測試的測試標準(續)

標準方法	特定測試
Geospec 3 – Test Method 10.1	Determination of Dry Density/Moisture Content Relationship of Soils Containing Particles Which are Not Susceptible to Crushing (Using 1000 cc Mould and 2.5 kg Rammer)
Geospec 3 – Test Method 10.2	Determination of Dry Density/Moisture Content Relationship of Soils Containing Particles Which are Susceptible to Crushing (Using 1000 cc Mould and 2.5 kg Rammer)
Geospec 3 – Test Method 10.3	Determination of Dry Density/Moisture Content Relationship of Soils Containing Particles Which are Not Susceptible to Crushing (Using CBR Mould and 2.5 kg Rammer)
Geospec 3 – Test Method 10.4	Determination of Dry Density/Moisture Content Relationship of Soils Containing Particles Which are Susceptible to Crushing (Using CBR Mould and 2.5 kg Rammer)
Geospec 3 – Test Method 10.5	Determination of Dry Density/Moisture Content Relationship of Soils Containing Particles Which are Not Susceptible to Crushing (Using 1000 cc Mould and 4.5 kg Rammer)
Geospec 3 – Test Method 10.6	Determination of Dry Density/Moisture Content Relationship of Soils Containing Particles Which are Susceptible to Crushing (Using 1000 cc Mould and 4.5 kg Rammer)
Geospec 3 – Test Method 10.7	Determination of Dry Density/Moisture Content Relationship of Soils Containing Particles Which are Not Susceptible to Crushing (Using CBR Mould and 4.5 kg Rammer)
Geospec 3 – Test Method 10.8	Determination of Dry Density/Moisture Content Relationship of Soils Containing Particles Which are Susceptible to Crushing (Using CBR Mould and 4.5 kg Rammer)
Geospec 3 – Test Method 11.1	Determination of In-situ Bulk Density and In-situ Dry Density of Soils by Sand Replacement Method Suitable for Fine- and Medium-grained Soils (With Small pouring Cylinder)
Geospec 3 – Test Method 11.2	Determination of In-situ Bulk Density and In-situ Dry Density of Soils by Sand Replacement Method Suitable for Fine-, Medium- and Coarse-grained Soils (With Large Pouring Cylinder)
Geospec 3 – Test Method 11.3	Determination of In-situ Bulk Density and In-situ Dry Density of Soils by Nuclear Densometer Method Suitable for Fine- and Medium-grained Soils
Geospec 3 – Test Method 11.4	Determination of Relative Compaction of Fill Material
Geospec 3 – Test Method 12.1	Determination of the California Bearing Ratio (CBR)

(2004年5月修訂)

“Geospec 3” 第二階段土壤測試的測試標準

標準方法	特定測試
Geospec 3 – Test Method 14.1	The One-dimensional Consolidation Test
Geospec 3 – Test Method 14.2	The Isotropic Compression Test in a Triaxial Cell
Geospec 3 – Test Method 15.1	The Unconsolidated Undrained Triaxial Compression Test Without Pore Pressure Measurement
Geospec 3 – Test Method 15.2	The Isotropically Consolidated Undrained Triaxial Compression Test With Pore Pressure Measurement
Geospec 3 – Test Method 15.3	The Isotropically Consolidated Drained Triaxial Compression Test With Measurement of Volume Change
Geospec 3 – Test Method 16.1	The Direct Shear Test (Small Shear Box Apparatus)
Geospec 3 – Test Method 16.2	The Direct Shear Test (Large Shear Box Apparatus)

(2004年5月)

附錄 C

(認可人士及註冊結構工程師作業備考 167)

(APP-64)

根據土力工程處報告第 36 號的第一階段土壤測試

測試方法	測試描述	與“Geospec 3” 等效測試方法
GEO Report No. 36 Test 2.3.2A	Determination of moisture content by oven-drying at 105°C±5°C	Geospec 3 – Test Method 5.2
GEO Report No. 36 Test 2.3.2B	Determination of moisture content by oven-drying at 45°C±5°C	Geospec 3 – Test Method 5.1
GEO Report No. 36 Test 2.3.2C	Comparative test for the determination of moisture content by oven-drying	Geospec 3 – Test Method 5.3
GEO Report No. 36 Test 2.4.3	Determination of liquid limit by the cone penetrometer method	Geospec 3 – Test Method 6.1 & 6.2
GEO Report No. 36 Test 2.5.3	Determination of plastic limit, plasticity index and liquidity index	
GEO Report No. 36 Test 2.9.2A	Determination of particle size distribution by wet sieving (with dispersant)	Geospec 3 – Test Method 8.1
GEO Report No. 36 Test 2.9.2B	Determination of particle size distribution by wet sieving (without dispersant)	Geospec 3 – Test Method 8.2
GEO Report No. 36 Test 2.9.4A	Determination of particle size distribution by the pipette method (with dispersant)	Geospec 3 – Test Method 8.3
GEO Report No. 36 Test 2.9.4B	Determination of particle size distribution by the pipette method (without dispersant)	Geospec 3 – Test Method 8.4
GEO Report No. 36 Test 2.9.5A	Determination of particle size distribution by the hydrometer method (with dispersant)	Geospec 3 – Test Method 8.5
GEO Report No. 36 Test 2.9.5B	Determination of particle size distribution by the hydrometer method (without dispersant)	Geospec 3 – Test Method 8.6
GEO Report No. 36 Test 2.9.6	Construction of a continuous particle size distribution curve from the results of wet sieving and sedimentation tests	Geospec 3 – Test Method 8.7
GEO Report No. 36 Test 4.3.3A	Determination of the dry density/moisture content relationship of soils containing particles which are not susceptible to crushing (with 1000cc mould and 2.5kg rammer)	Geospec 3 – Test Method 10.1
GEO Report No. 36 Test 4.3.3B	Determination of the dry density/moisture content relationship of soils containing particles which are susceptible to crushing (with 1000cc mould and 2.5kg rammer)	Geospec 3 – Test Method 10.2

根據土力工程處報告第36號的第一階段土壤測試(續)

測試方法	測試描述	與“Geospec 3”等 效測試方法
GEO Report No. 36 Test 4.3.4A	Determination of the dry density/moisture content relationship of soils containing particles which are not susceptible to crushing (with CBR mould and 2.5kg rammer)	Geospec 3 – Test Method 10.3
GEO Report No. 36 Test 4.3.4B	Determination of the dry density/moisture content relationship of soils containing particles which are susceptible to crushing (with CBR mould and 2.5kg rammer)	Geospec 3 – Test Method 10.4
GEO Report No. 36 Test 9.2.1	Determination of the insitu bulk density and insitu dry density of soil by the sand replacement method suitable for fine- and medium-grained soils (with small pouring cylinder)	Geospec 3 – Test Method 11.1
GEO Report No. 36 Test 9.2.2	Determination of the insitu bulk density and insitu dry density of soil by the sand replacement method suitable for fine-, medium- and coarse-grained soils (with large pouring cylinder)	Geospec 3 – Test Method 11.2

- 註:
- (1) 應採用土力工程處報告第36號附錄A內有關實驗所的一般規定及樣本製備的指引。
 - (2) 對於所有涉及含水量檢定的測試，應向實驗所提供有關土壤類型及焗爐烘乾溫度的資料。

(2004年5月)