NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

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PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: GEOTECHNICAL SURVEY TECHNICIAN

LEVEL: NTA 4

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ABBREVIATIONS

CBET	Competency Based Education and Training
GNSS	Global Navigation Satellite System
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
RTK	Real-time Kinematic
TET	Technical Education and Training
TVET	Technical and Vocational Education and Training

GLOSSARY OF TERMS

Circumstantial Knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues.
Competence:	The ability to use knowledge, understanding, practical, and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based Education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".
Educational/Training Programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks – essentially the same tasks are performed by all employees having the same title. (Example: baker)
Occupational Area:	This is a broad grouping of related jobs. (Example: food service)
Occupational Competence:	The application of knowledge and skills that consistently meet the standards required by the work context.
Occupational Standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as a performance tool of assessment of the prescribed outcomes.
Occupational/Job Analysis:	A process used to identify the tasks that are important to employees in any given occupation**.**
Performance Criteria:	Indicate expected end results or outcomes in the form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.

Standards:	A set of statements, which if proved true under working conditions, means that an individual is meeting an expected level and type of performance.
Task Analysis:	The process of analysing each task to determine the steps, circumstantial knowledge, attitudes, performance standards, tools and materials needed, as well as safety concerns required for the employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, and consists of two or more definite steps that leads to a product, service, or decision.
Underpinning Knowledge:	Crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
Verification Process:	The process of having experts review and confirm the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.

1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical Education has begun the job of drafting Occupational Standards that will eventually be adopted as National Occupational Standards for TET in order to ensure that it meets the needs of the labour market and the country's economic agenda.

National Occupational Standards (NOS) are performance criteria that are matched with labour market demands. Each National Occupation Standard describes functions, performance standards, and knowledge/understanding for one important function or task. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruiting, supervision, and appraisal, as well as TET standards. They're also helpful for benchmarking and harmonizing qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current, and consistent in delivery across all public and private institutions.

However, it must be noted that, Occupational Standards and Training standards/qualifications standards are different. Occupational standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical wiring circuits, performs troubleshooting in electrical wiring, etc.) and they are usually defined by employers following procedures agreed upon by all stakeholders. Education and training standards are developed from the activities defined in occupational standards, and they include learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him or her to function at an agreed level in an occupation. Education and Training standards are used to define curricula in training institutions. It is however critical that there must be a direct link between the occupational standards and the training standards to respond to the demands of the labour market.

In TET delivery, Tanzania adopted the Competence Based Education and Training (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the occupational standards. Occupational standards are thus the starting point for developing competency-based training (CBET) programmes. TET institutions will be required to benchmark their curricula with relevant occupational standards.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training (TET).

The Geotechnical Survey Technician Occupation has its own set of occupational standards. The document explains how the occupational standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0. OCCUPATIONAL STANDARD DEVELOPMENT PROCESS

The Occupational standards development process began with an examination of major documents that guide Tanzanian skill development. The *10-year National Skills Development Strategy (2016-2026)* was one of the documents reviewed, and it outlined six (6) economic sectors that should be prioritized when developing skills development programmes.

These sectors include: Transport and Logistics, Tourism and Hospitality, Agribusiness, Construction, Energy and ICT. NACTE labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a workshop comprised of expert workers and educators with substantial knowledge and experience in the occupation conducted an occupational analysis utilizing the DACUM approach to produce the occupational profile. The analysis resulted in DACUM Charts, which are attached as **Appendix 1** to this document.

The occupational standards were then developed. Experts in Occupational Analysis and the Development of Occupational Standards facilitated the workshop. Interviews, online surveys, and a stakeholder forum were used to validate the Occupational Standards. Geotechnical engineers, technicians, and experienced Geotechnical Survey Technicians were key informants in the survey to discover occupational trends. This information was used to gain insight from the workplaces regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation. A total of ... online surveys were completed by experts from the labour market across the country. Apart from the surveys aiding in defining the scope for the occupational analysis, they also served to engage a wide cross-section of experts in the occupation. Apart from this, the stakeholders' forum was attended by …….. participants from different parts of the country representing various companies.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR GEOTECHNICAL SURVEY TECHNICIANS

The standards cover a broad range of duties and tasks that can be performed by a Geotechnical Survey Technician However, the occupational standards are not meant to replace individual job

descriptions. Instead, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Geotechnical Survey Technician may perform tasks in a number of key areas of the occupational standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

The Geotechnical Survey Technicians shall, under the supervision of geotechnical engineers, in laboratories, offices or construction sites, engage in laboratorial geotechnical testing, engineering geological mapping and investigation, engineering geological exploration and evaluation, geotechnical engineering construction and management, geotechnical engineering testing, etc.
Generally, the Geotechnical Survey Technician performs the following responsibilities:

a) Engineering geological surveying and mapping

b) Geotechnical survey scheme design

c) Geotechnical survey points measurement and setting

d) Geological documentation of drill holes

e) Sample collection

f) In-situ tests

g) Hydrogeological survey

h) Geotechnical tests

i) Water assay

j) Drawing of geotechnical survey maps

k) Geotechnical report compiling

l) Geotechnical engineering construction and management

m) Geotechnical engineering detection

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA level 4, 5 and 6.

4.0. VALIDITY PERIOD

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

5.0. OCCUPATIONAL STANDARDS

5.1. OCCUPATIONAL STANDARDS FOR GEOTECHNICAL SURVEY TECHNICIAN - NTA 4

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL EXPLORATORY SPOTS MEASUREMENT AND SETTING AND IN-SITU TESTS	**DUTY NO.**	401
TASK TITLE	COORDINATE MEASUREMENT OF EXPLORATORY SPOTS	**TASK NO.**	4011
PERFORMANCE CRITERIA	The person performing this task must be able to carry out the coordinate measurement of exploratory spots in accordance with standards and guidelines approved by engineering investigation and design units.		
RANGE STATEMENT	The task can be performed on the survey site under the supervision of geotechnical engineers. The tools and equipment to be used include: 1. Layout charts of exploratory spots; 2. Total station or GNSS-RTK; 3. Tape measure and steel tape; 4. Personal protective equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Obtain the tools and equipment required for performing this task; 2. Identify drawings for operations; 3. Survey the topographic features inside and outside the operating sites and select suitable control points; 4. Set up the total station or the GNSS-RTK base station and mobile station; 5. Set exploratory spots in accordance with the layout chart; 6. Mark exploratory spots in the survey site; 7. Clean and arrange instruments and equipment; 8. Store instruments and equipment and safety protection articles.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Conduct on-the-spot surveys on operating sites; 1.2 Select methods of coordinate measurement of exploratory spots, and choose instruments and equipment, and safety protection articles; 1.3 Measure and set exploratory spots using total stations and GNSS-RTK. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 The principle of coordinate lofting. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Coordinate lofting methods. **4.0 Essential Skills**

	4.1 Communication skills; 4.2 Teamwork skills; 4.3 Learning skills; 4.4 Drawing reading skills. **5.0 Math Skills** 5.1 Trigonometric operation; 5.2 Plane analytic geometry; 5.3 Functional operation.
DESCRIPTION OF THE END PRODUCT / SERVICE	The coordinate lofting is conducted in accordance with the standards and guidelines approved by the competent authorities and the layout charts of exploratory spots approved by the survey units.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of outdoor production safety; 4. Eco-friendly survey methods.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL EXPLORATORY SPOTS MEASUREMENT AND SETTING AND IN-SITU TESTS	**DUTY NO.**	401
TASK TITLE	LEVEL MEASUREMENT OF EXPLORATORY SPOTS	**TASK NO.**	4012
PERFORMANCE CRITERIA	The person performing this task must be able to carry out the elevation surveying of exploratory spots in accordance with standards and guidelines approved by engineering investigation and design units.		
RANGE STATEMENT	The task can be performed on the survey site under the supervision of geotechnical engineers. 1. Layout charts of exploratory spots; 2. Level gauges and total stations; 3. Measurement record table record tables; 4. Personal protective equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Obtain the tools and equipment required for performing this task; 2. Identify drawings for operations; 3. Survey the topographic features inside and outside the operating sites; 4. Select the elevation reference point; 5. Set up the survey station; 6. Measure the height difference from the reference point to the exploratory spot; 7. Record and calculate the elevation of the exploratory spot; 8. Clean and arrange instruments and tools; 9. Store instruments and equipment and safety protection articles.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Conduct on-the-spot surveys on operating sites; 1.2 Select methods of elevation surveying of exploratory spots, and choose instruments and equipment, and safety protection articles; 1.3 Set up the survey station; 1.4 Measure, calculate, and record the elevation of exploratory spots. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of leveling survey; 2.2 Principles of trigonometric leveling. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Methods of elevation surveying. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills;

	4.3 Learning skills; 4.4 Drawing reading skills. **5.0 Math Skills** 5.1 Trigonometric operation; 5.2 Plane analytic geometry; 5.3 Functional operation.
DESCRIPTION OF THE END PRODUCT / SERVICE	The level measurement of exploratory spots is conducted in accordance with the standards and guidelines approved by the competent authorities.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of outdoor production safety; 4. Eco-friendly survey methods.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL EXPLORATORY SPOTS MEASUREMENT AND SETTING AND IN-SITU TESTS	**DUTY NO.**	401
TASK TITLE	SAMPLE COLLECTION (ROCK, SOIL, AND WATER)	**TASK NO.**	4013
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct the sample collection in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed on the survey site under the supervision of geotechnical engineers. The tools and equipment to be used include: 1. Open-tube thick-walled soil samplers and sectioned-tube thin-walled samplers; 2. Soil and water sample containers; 3. Marble powder; 4. Wax, tapes, bandages, and brushes; 5. Sample labels; 6. Sample storage tank.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Guide drilling technicians to use samplers to collect test samples (e.g. rock, soil, and water); 3. Pack samples; 4. Fill and paste the sample labels; 5. Store samples; 6. Send samples for testing.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select sampling methods and samplers; 1.2 Collect samples; 1.3 Send samples for testing. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Factors affecting the sample quality; 2.2 Requirements for classification of geological samples. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The operating procedure of geological sample collection. **4.0 Essential Skills** 4.1 Communication skills;

	4.2 Teamwork skills; 4.3 Learning skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Qualified samples are collected and handover sheets are filled in accordance with the standards and guidelines approved by the competent authorities.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of outdoor production safety; 4. Eco-friendly survey methods.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL EXPLORATORY SPOTS MEASUREMENT AND SETTING AND IN-SITU TESTS	**DUTY NO.**	401
TASK TITLE	STATIC CONE PENETRATION TESTS	**TASK NO.**	4014
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct the static cone penetration test in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed on the survey site under the supervision of geotechnical engineers. The tools and equipment to be used include: 1. Static cone penetration equipment (principal machines, ground anchors, etc.); 2. Static cone penetrometers (with single-bridge, double-bridge or triple-bridge probes); 3. Static cone penetration test data recorders; 4. Data record tables or data storage flash drives.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	UNDERPINNING KNOWLEDGE
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Install and connect instruments and equipment; 3. Conduct static cone penetration tests; 4. Record test data or copy data from the recorder to the flash drive; 5. Dismantle and clean instruments; 6. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select the appropriate static cone penetration equipment according to site conditions; 1.2 Install and connect instruments and equipment; 1.3 Conduct static cone penetration test on site; 1.4 Record or copy test data. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 The principle and applicable scope of static cone penetration test; 2.2 Possible problems, reasons and solutions during the test; 2.3 The internal relationship between physical and mechanical parameters of foundation soil and static cone penetration test data. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The operating procedure of static cone penetration test.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Learning skills. **5.0 Math Skills** 5.1 Mathematical statistics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Static cone penetration tests are conducted and result forms are filled out in accordance with the standards and guidelines approved by the competent authorities.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of outdoor production safety; 4. Eco-friendly survey methods.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL EXPLORATORY SPOTS MEASUREMENT AND SETTING AND IN-SITU TESTS	**DUTY NO.**	401
TASK TITLE	STANDARD PENETRATION TESTS	**TASK NO.**	4015
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct the standard penetration test in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed on the survey site under the supervision of geotechnical engineers. 1. Exploratory drilling rigs (including Φ42 drill rods) and supporting construction personnel; 2. Drop hammer (hammer weight: 63.5kg, drop distance: 76cm); 3. Penetrators; 4. Steel tapes; 5. Record tables.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Guide technicians to assemble the drilling equipment for standard penetration tests and to place penetrators in the test position of the drill hole; 3. Guide technicians to conduct standard penetration tests; 4. Record the test data (hammering times, rod length, etc.); 5. Extract and open penetrators, and identify and describe the soil sample; 6. Clean the tools and equipment; 7. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Install equipment of the standard penetration test; 1.2 Conduct standard penetration tests on site; 1.3 Record test data; 1.4 Describe the soil sample. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 The principle and applicable scope of standard penetration tests; 2.2 The internal relationship between physical and mechanical parameters of foundation soil and hammering times of standard penetration tests; 2.3 Possible problems, reasons and solutions during the test. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The operating procedure of standard penetration tests.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Learning skills. **5.0 Math Skills** 5.1 Mathematical statistics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Standard penetration tests are conducted and result forms are filled out in accordance with the standards and guidelines approved by the competent authorities.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of outdoor production safety; 4. Eco-friendly survey methods.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL EXPLORATORY SPOTS MEASUREMENT AND SETTING AND IN-SITU TESTS	**DUTY NO.**	401
TASK TITLE	CONE DYNAMIC PENETRATION TESTS	**TASK NO.**	4016
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct the cone dynamic penetration test in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed on the survey site under the supervision of geotechnical engineers. 1. Exploratory drilling rigs (including Φ25, Φ42 and Φ50 drill rods) and supporting construction personnel; 2. Drop hammers of cone dynamic penetration (10kg light hammer, 63.5kg heavy hammer, 120kg super-heavy hammer); 3. Probes; 4. Steel tapes; 5. Record tables.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Guide technicians to assemble the drilling equipment for cone dynamic penetration tests and to place probes in the test position of the borehole; 3. Guide technicians to conduct cone dynamic penetration tests; 4. Record the test data; 5. Disassemble and clean the tools and equipment; 6. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Install equipment of the cone dynamic penetration test; 1.2 Conduct cone dynamic penetration tests on site; 1.3 Record the test data of cone dynamic penetration tests. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 The principle, applicable scope, and operating procedure of cone dynamic penetration tests; 2.2 The internal relationship between physical and mechanical parameters of foundation soil and hammering times of cone dynamic penetration tests; 2.3 Possible problems, reasons and solutions during the test. **3.0 Theories** The person performing this task must be able to explain the following:

	3.1 The operating procedure of cone dynamic penetration tests. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Learning skills. **5.0 Math Skills** 5.1 Mathematical statistics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Cone dynamic penetration tests are conducted and result forms are filled out in accordance with the standards and guidelines approved by the competent authorities.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of outdoor production safety; 4. Eco-friendly survey methods.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL EXPLORATORY SPOTS MEASUREMENT AND SETTING AND IN-SITU TESTS	**DUTY NO.**	401
TASK TITLE	PRESSUREMETER TESTS	**TASK NO.**	4017
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct the pressuremeter test in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed on the survey site under the supervision of geotechnical engineers. The tools and equipment to be used include: 1. Prebored pressuremeters (including pressuremeters, pressure and volume controller, pipelines, drilling tools, and the deformation surveying system); 2. Pumps and nitrogen; 3. Pressuremeter test records.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Drill test holes; 3. Assemble equipment of the pressuremeter test; 4. Calibrate the equipment, including the binding force of elastic modulus and the overall deformation modulus of equipment; 5. Conduct zero setting before tests; 6. Place the pressuremeter into the hole at the desired depth; 7. Set the loading grade at each point and conduct the stage loading; 8. Record test data; 9. Disassemble and clean the tools and equipment; 10. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Drill test holes; 1.2 Assemble equipment of the pressuremeter test; 1.3 Conduct the instrument calibration; 1.4 Conduct zero setting; 1.5 Set the loading grade at each point and conduct the stage loading; 1.6 Record test data. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 The principle and applicable scope of pressuremeter tests; 2.2 The relationship between the strength and deformation of foundation soil; 2.3 Possible problems, reasons and solutions during the test. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The operating procedure of pressuremeter test.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Learning skills. **5.0 Math Skills** 5.1 Mathematical statistics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Pressuremeter tests are conducted and result forms are filled out in accordance with the standards and guidelines approved by the competent authorities.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of outdoor production safety; 4. Eco-friendly survey methods.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL EXPLORATORY SPOTS MEASUREMENT AND SETTING AND IN-SITU TESTS	**DUTY NO.**	401
TASK TITLE	VANE SHEAR TESTS	**TASK NO.**	4018
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct the vane shear test in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed on the survey site under the supervision of geotechnical engineers. The tools and equipment to be used include: 1. The cross vane; 2. The probing rod for tests; 3. The principal machine of penetrators; 4. Force measuring devices; 5. Dial indicators and stopwatches; 6. Recorders; 7. Personal protective equipment, including safety helmets, gloves, safety shoes, and work clothes.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	UNDERPINNING KNOWLEDGE
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Install equipment of the vane shear test; 3. Apply torque to the equipment and conduct the vane shear test; 4. Record test data; 5. Disassemble and clean the tools and equipment; 6. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Install equipment of the vane shear test; 1.2 Apply torque to the equipment and conduct the vane shear test; 1.3 Record test data. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 The principle and applicable scope of the vane shear test; 2.2 The implication of shearing strength and sensitivity of foundation soil; 2.3 Possible problems, reasons and solutions during the test. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The operating procedures of the vane shear test.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Learning skills. **5.0 Math Skills** 5.1 Mathematical statistics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Vane shear tests are conducted and result forms are filled out in accordance with the standards and guidelines approved by the competent authorities.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of outdoor production safety; 4. Eco-friendly survey methods.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL EXPLORATORY SPOTS MEASUREMENT AND SETTING AND IN-SITU TESTS	**DUTY NO.**	401
TASK TITLE	FLAT DILATOMETER TESTS	**TASK NO.**	4019
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct the flat dilatometer test in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed on the geotechnical engineering survey site under the supervision of geotechnical engineers. The tools and test equipment to be used include: 1. Probes for flat dilatometer test; 2. Measurement and control boxes; 3. Rating gas pressure gauges; 4. Gas-electric lines; 5. Pressure sources; 6. Penetrating equipment; 7. Personal protective equipment, including safety helmets, gloves, safety shoes, and work clothes.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Calibrate probes for the flat dilatometer test; 3. Install equipment for the flat dilatometer test; 4. Use penetrating equipment to send the probe of the flat dilatometer test at a constant speed to the desired depth; 5. Carry out pressurization and depressurization to record the pressure value of the flat dilatometer test probe membrane when it expanded to 0.05mm, 0.10mm and back to 0.05mm; 6. Record test data; 7. Disassemble and clean the tools and equipment; 8. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Choose the location of test sites and soil layers for performing flat dilatometer tests; 1.2 Calibrate probes; 1.3 Install the test equipment; 1.4 Inject the probes; 1.5 Carry out pressurization and depressurization; 1.6 Record test data. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 The principles and applicable scope of flat dilatometer tests; 2.2 The implication of foundation soil static lateral pressure coefficient and horizontal bedding coefficient; 2.3 Possible problems, reasons and solutions during the test.

	3.0 Theories The person performing this task must be able to explain the following: 3.1 Operating procedures of flat dilatometer tests. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Learning skills. **5.0 Math Skills** 5.1 Mathematical statistics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Flat dilatometer tests are conducted and result forms are filled out in accordance with the standards and guidelines approved by the competent authorities.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of outdoor production safety; 4. Eco-friendly survey methods.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL EXPLORATORY SPOTS MEASUREMENT AND SETTING AND IN-SITU TEST	**DUTY NO.**	401
TASK TITLE	FOUNDATION SOIL PLATE LOADING TESTS	**TASK NO.**	40110
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct the foundation soil plate loading test in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed on the survey site under the supervision of geotechnical engineers. The tools and equipment to be used include: 1. Pressure stabilization and loading devices (jacks, oil pumps, pressure gauges, etc.); 2. Counterforce devices (steel beams and pile loads or anchors and trusses); 3. Loading plates; 4. Settlement observation devices (reference beams, dial indicators, magnetic base indicator holders, settlement sensors, etc.).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Select the equipment for plate loading tests; 3. Dig the test pits; 4. Set counterforce systems and install the test equipment; 5. Determine the loading grade and start the oil pump to conduct stage loading; 6. Identify the test termination criteria and end the test; 7. Record test data at all levels; 8. Disassemble and clean the tools and equipment; 9. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Choose the ways to conduct plate loading tests according to the characteristics of site soil layers; 1.2 Dig the test pits and install test equipment; 1.3 Determine the loading grade, conduct stage loading and identify the test termination criteria; 1.4 Record test data. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of foundation soil plate loading tests; 2.2 The relationship between the bearing capacity and settlement deformation of foundation soil; 2.3 Possible problems, reasons and solutions during the test. **3.0 Theories** The person performing this task must be able to explain

	the following: 3.1 Operating procedures of foundation soil plate loading tests. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Learning skills. **5.0 Math Skills** 5.1 Mathematical statistics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Plate loading tests are conducted and result forms are filled out in accordance with the standards and guidelines approved by the competent authorities.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of outdoor production safety; 4. Eco-friendly survey methods.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	OPERATION AND DATA RECORDING OF GEOTECHNICAL TESTS	**DUTY NO.**	402
TASK TITLE	TEST OPERATIONS AND DATA RECORDING OF PARTICLE-SIZE ANALYSIS TEST OF SANDY SOIL	**TASK NO.**	4021
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct the particle-size analysis test of sandy soil in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed in the laboratory under the supervision of geotechnical engineers. The tools and equipment to be used include: 1. Standard sieves for particle-size analysis tests; 2. Ordinary balances (weight: 1,000g, division value: 0.1g; weight: 200g, division value: 0.01g); 3. Platform scales (weight: 5kg, division value: 1g); 4. Sieve shakers; 5. Dryers; 6. Measuring cylinders, funnels, porcelain cups, grinding bowls, porcelain plates, brushes, spoons, wooden mills, etc.; 7. Record tables.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Prepare samples using the air-drying method; 3. Take soil samples using the quartering method and pour them into the uppermost compartment of the standard sieve; 4. Using sieve shakers to shake and sieve the samples; 5. Accurately weight the quality of samples on all levels of sieve frames and inside the chassis, and record the results; 6. Disassemble and clean the tools and equipment; 7. Store the equipment and tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select the instruments and equipment; 1.2 Prepare samples; 1.3 Conduct the particle-size analysis test of sandy soil using the sieve analysis method; 1.4 Record the test results. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Soil types and classification standards; 2.2 Possible problems, reasons and solutions during the test. **3.0 Theories** 3.1 Operating procedures of the particle-size analysis test of sandy soil.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Drawing skills; 4.4 Learning skills. **5.0 Math Skills** 5.1 Mathematical statistics; 5.2 Functional operation.
DESCRIPTION OF THE END PRODUCT / SERVICE	The particle-size analysis test of sandy soil is completed in accordance with the standards and guidelines approved by the competent authorities, and the record table is filled out.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Safety knowledge of laboratory; 4. Disposal methods for laboratory waste.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	OPERATION AND DATA RECORDING OF GEOTECHNICAL TESTS	**DUTY NO.**	402
TASK TITLE	CONVENTIONAL TEST OPERATIONS AND DATA RECORDING OF SOIL	**TASK NO.**	4022
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct the conventional tests of soil in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed in the laboratory under the supervision of geotechnical engineers. The tools and equipment to be used include: 1. Coulter knives and wire saws; 2. Cutting rings; 3. Dial indicators; 4. Porous discs; 5. Balances (weight: 500g, division value: 0.1g; weight: 200g, division value: 0.01g); 6. Conical liquid limit apparatus; 7. Lever-type compression apparatus; 8. Strain-controlled direct shear apparatus; 9. Dryers; 10. Standard sieves; 11. Aluminum boxes, soil mixing cups, soil mixing knives and soil trimming knives; 12. Grinding bowls and rubber-head pestles; 13. Desiccators and bulldozers; 14. Other equipment and tools: vaseline, filter paper or wax paper, stopwatches, straightedges, ground glass boards, droppers, blowers and goniometers; 15. Test data record tables.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Prepare samples; 3. Conduct tests such as natural moisture content, natural density, liquid-plastic limit, compression and direct shear of soil samples; 4. Record test data; 5. Clean the tools and equipment; 6. Store the equipment and tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Prepare instruments and equipment; 1.2 Prepare samples; 1.3 Conduct tests such as natural moisture content, natural density, liquid-plastic limit, compression and direct shear of soil samples; 1.4 Record test data. **2.0 Principle**

	The person performing this task must be able to explain the following principles: 2.1 Concepts of natural density, natural moisture content, boundary moisture content, compressibility and shearing strength of clay; 2.2 The correlation between geotechnical parameters. **3.0 Theories** 3.1 Operating procedures of testing the moisture content of soil; 3.2 Operating procedures of testing the density of soil; 3.3 Operating procedures of testing the liquid limit and plastic limit of soil; 3.4 Operating procedures of testing the direct shear of soil; 3.5 Operating procedures of detecting the compressibility of soil. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Drawing skills; 4.4 Learning skills. **5.0 Math Skills** 5.1 Mathematical statistics; 5.2 Functional operation.
DESCRIPTION OF THE END PRODUCT / SERVICE	Conventional tests of soil are completed in accordance with the standards and guidelines approved by the competent authorities and the data is recorded.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Safety knowledge of laboratory; 4. Disposal methods for laboratory waste.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL ENGINEERING CONSTRUCTION	**DUTY NO.**	403
TASK TITLE	GEOTECHNICAL ENGINEERING CONSTRUCTION AND SETTING OUT	**TASK NO.**	4031
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct geotechnical engineering construction and setting out in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed at the construction site under the supervision of geotechnical engineers. The tools and equipment to be used include: 1. Construction design drawings of geotechnical engineering and design schemes of construction organization; 2. Measuring instruments (total stations, level gauges, GNSS-RTK equipment, etc.); 3. Coordinates and elevation control points; 4. Record books, pencils, tape measures, steel tapes, etc.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Recheck the coordinate and elevation of control points; 3. Select and set up the survey station; 4. Conduct construction and setting out; 5. Record the data of setting out; 6. Disassemble and clean the measuring equipment; 7. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select the measuring instruments for construction and setting out; 1.2 Select and set up the survey station; 1.3 Measure and set construction point lines. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principles of engineering surveying. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Operation methods for construction and setting out; 3.2 Technical requirements of engineering surveying; 3.3 Methods for drawing the corresponding graphics using the measured data. **4.0 Essential Skills**

	4.1 Communication skills; 4.2 Teamwork skills; 4.3 Office software operation skills; 4.4 Drawing skills; 4.5 Learning skills. **5.0 Math Skills** 5.1 Mathematical statistics; 5.2 Plane analytic geometry; 5.3 Trigonometric operation.
DESCRIPTION OF THE END PRODUCT / SERVICE	Control points and lines of the construction sites are measured and set in accordance with the standards and guidelines approved by the competent authorities and the requirements of construction units.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of work safety in architectural engineering.

OCCUPATION	GEOTECHNICAL SURVEY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	GEOTECHNICAL ENGINEERING CONSTRUCTION	**DUTY NO.**	403
TASK TITLE	EARTHWORK CONSTRUCTION	**TASK NO.**	4032
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct earthwork construction in accordance with the standards and specifications approved by the competent authorities.		
RANGE STATEMENT	The task can be performed at the construction site under the supervision of geotechnical engineers. The tools and equipment to be used include: 1. Earthwork construction design drawings; 2. Construction organization design schemes; 3. Communication devices, computers and other office equipment; 4. Measuring instruments (total stations, level gauges, GNSS-RTK equipment, etc.); 5. Construction records.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	UNDERPINNING KNOWLEDGE
The person performing this task must be able to do the following: 1. Select the right tools, instruments and protective equipment; 2. Read the construction graph and construction organization design schemes; 3. Identify the types of rock and soil; 4. Dispatch construction equipment and staff; 5. Locate earthwork construction sites; 6. Direct construction personnel to carry out on-site earthwork construction in accordance with the requirements of the construction organization design schemes; 7. Write and submit construction records and other relevant construction information.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Read the construction graph and construction organization design schemes; 1.2 Divide the types of earthwork construction; 1.3 Organize construction equipment and staff; 1.4 Locate the earthwork construction sites; 1.5 Organize on-site earthwork construction; 1.6 Write and submit construction records. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Foundation of mechanical principles; 2.2 Applicable scopes for earthmoving machines; 2.3 Geological basis of engineering and hydrology. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Earthwork construction specifications; 3.2 Methods of organizing earthwork construction information.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Drawing reading skills; 4.4 Learning skills. **5.0 Math Skills** 5.1 Functional operation.
DESCRIPTION OF THE END PRODUCT / SERVICE	On-site earthwork construction is performed in accordance with the standards and guidelines approved by the competent authorities and the requirements of construction units.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Laws and regulations of construction projects; 2. Occupational ethics; 3. Knowledge of work safety in architectural engineering.

TABLE 1: DACUM CHARTS FOR GEOTECHNICAL SURVEY TECHNICIAN - NTA 4

DUTIES	TASKS	ENABLERS
1.0 Geotechnical exploratory spots measurement and setting and in-situ test	1.1 Coordinate measurement of exploratory spots. 1.2 Level measurement of exploratory spots. 1.3 Sample collection (rock, soil, and water). 1.4 Static cone penetration tests. 1.5 Standard penetration tests. 1.6 Cone dynamic penetration tests. 1.7 Pressuremeter tests. 1.8 Vane shear tests. 1.9 Flat dilatometer tests. 1.10 Foundation soil plate loading tests.	**General skills and knowledge** · Certain communication skills to cooperate and communicate with related parties and report to superiors · Conducting of on-the-spot surveys on operating sites in accordance with the requirements · Selection of methods of coordinate measurement and elevation surveying of exploratory spots, instruments and equipment, and safety protection articles · Mastery of the principles of engineering surveying · Mastery of commonly-used methods for engineering surveying · Measurement and setting of exploratory spots using total stations and GNSS-RTK · Measurement, calculation and recording of the elevation of exploratory spots · Mastery of the factors affecting the quality of samples and the requirements for the classification of sample levels · Mastery of the operating procedure of sample collection · Selection of sampling methods and samplers in accordance with the requirements · Collection and sending of samples for testing · Mastery of the principles and applicable scopes of various kinds of in-situ test methods · Mastery of the operating procedures of various kinds of in-situ tests · Completion of various in-situ tests in accordance with the purpose of geotechnical survey · Understanding of the possible problems, causes and solutions during various in-situ tests · Understanding of the implication of shearing strength and sensitivity of foundation soil · Understanding of the implication of foundation soil static lateral pressure coefficients and horizontal bedding

DUTIES	TASKS	ENABLERS
		coefficients · Understanding of the internal relations between physical mechanics parameters of foundation soil and in-situ tests · Application writing skills · Graph reading and drawing skills · Learning skills **Tools and equipment** · Personal protective equipment such as safety shoes, gloves and safety helmets · Measuring instruments: level gauges, total stations and GNSS-RTK equipment, · glass bottles and sample collection containers · Static cone penetration equipment, cone dynamic penetration equipment, standard penetration test equipment, pressuremeter test equipment, vane shear test equipment, flat dilatometer test equipment, plate loading test equipment, etc. **Requirements for employees** · Teamwork awareness, honesty and trustworthiness, safety awareness and environmental protection awareness
2.0 Operations and data recording of geotechnical tests	2.1 Test operations and data recording of particle-size analysis test of sandy soil. 2.2 Conventional test operations and data recording of soil.	**General skills and knowledge** · Certain communication skills to cooperate and communicate with related parties and report to superiors · Mastery of the types and classification criteria of sandy soil · Conducting of the particle-size analysis test of sandy soil using the sieve analysis method and recording of the results · Understanding of the concepts of natural density, natural moisture content, boundary moisture content, compressibility and shearing strength of clay · Mastery of the operating procedures of the particle-size analysis test of sandy soil · Mastery of the operating procedures for testing the moisture content, liquid limit, plastic limit and direct shearing and

DUTIES	TASKS	ENABLERS
		detect the compressibility of soil · Conducting of tests such as natural moisture content, natural density, liquid-plastic limit, compression and direct shear of soil samples and test data recording · Understanding of possible problems, reasons and solutions during the test · Understanding of the correlation between geotechnical parameters · Application writing skills · Drawing skills · Learning skills **Tools and equipment** · Personal protective equipment such as safety shoes, goggles, gloves and safety helmets · Standard sieves, ordinary balances (weight: 500g, minimum division value: 0.1g), magnetic bowls, rubber-head pestles, brushes, white paper, rulers, etc. · Coulter knives, wire saws, cutting rings (inner diameter: 61.8mm, height: 20mm), dial indicators (range: 10mm, division value: 0.01mm) or sensors (accuracy: level 0), porous discs (the diameter should be less than 0.2-0.5mm of the inside diameter of cutting rings), balances (weight: 200g, division value: 0.01g), aluminum boxes, soil mixing cups, soil mixing knives, grinding bowls, rubber-head pestles, dryers, desiccators, soil trimming knives, bulldozers, vaseline, filter paper or wax paper, stopwatches, straightedges, ground glass boards, droppers, blowers, standard sieves with 0.5mm apertures, goniometers, conical liquid limit apparatus, lever-type compression apparatus, strain-controlled direct shear apparatus, etc. **Requirements for employees** · Teamwork awareness, honesty and trustworthiness, safety awareness and environmental protection awareness
3.0 Geotechnical	3.1 Geotechnical engineering	**General skills and knowledge**

DUTIES	TASKS	ENABLERS
engineering construction	construction and setting out. 3.2 Earthwork construction.	· Certain communication skills to cooperate and communicate with related parties and report to superiors · Mastery of the basic principles of engineering surveying · Mastery of technical requirements for engineering surveying · Mastery of the methods for drawing the corresponding graphics using the measured data. · Selection of construction and setting out measuring instrument in accordance with requirements · Rechecking of the coordinate and elevation of control points · Measuring and setting of construction point lines · Reading of the construction graph and construction organization design schemes · Mastery of the foundation of mechanical principles · Mastery of geological basis of engineering and hydrology · Mastery of the applicable scopes of earthmoving machines · Mastery of the methods of calculating the productivity of earthmoving machines · Mastery of the methods of filling out the earthwork construction data records · Division of the types of earthwork construction · Organization of construction equipment and personnel · Location of the earthwork construction sites · Organization of on-site earthwork construction · Application writing skills · Graph reading and drawing skills · Learning skills **Tools and equipment** · Personal protective equipment such as safety shoes, goggles, gloves and safety helmets · Communication devices, computers and other office equipment

DUTIES	TASKS	ENABLERS
		· Measuring tapes, theodolites, measuring bars, level gauges, total stations, GNSS-RTK equipment, prism targets, etc. · Construction organization design schemes · Construction management platforms **Requirements for employees** · Hard-working spirit, sense of teamwork, honesty and trustworthiness, safety awareness and environmental protection awareness