

**NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND
TRAINING**



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PROPOSED OCCUPATIONAL STANDARDS

**OCCUPATION: WATER CONSERVANCY AND HYDROPOWER ENGINEERING
TECHNICIAN**

LEVEL: NTA 5

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ABBREVIATIONS

CBET	Competency Based Education and Training
CEC	Concret Engineering Construction
CRW	Construction of Rebar Works
DRO	Drilling Rig Operation
EC	Earthwork Construction
HGO	Hydraulic Gate Operation
HM	Hydrological Monitoring
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
TET	Technical Education and Training
TVET	Technical and Vocational Education and Training
WCPM	Water Conservancy Project Monitoring
WCOCM	Water Conservancy Organization and Construction Management

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 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 Water Conservancy and Hydropower Engineering Technician 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 STANDARDS 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. Engineers, supervisory technicians on the job, and experienced Water Conservancy and Hydropower Engineering 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 survey 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 OCCUPATIONAL STANDARDS FOR WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIANS

The standards cover a broad range of duties and tasks that can be performed by a Water Conservancy and Hydropower Engineering 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 Water

Conservancy and Hydropower Engineering 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 Water Conservancy and Hydropower Engineering Technician works under the supervision of the engineer, operating the drilling rig to complete drilling construction, and overseeing the construction site, including earthwork and reinforced concrete works. Additionally, they are required to perform water conservancy project monitoring and maintenance, hydraulic gate operation and maintenance, and hydrological surveys. Generally, the Water Conservancy and Hydropower Engineering Technician performs the following responsibilities:

- a) Operation of the drilling rig
- b) Identification and selection of earthwork construction machinery (equipment)
- c) Operation and maintenance of earthwork construction machinery (equipment)
- d) Preparation of earthwork construction scheme and offering of onsite guidance
- e) Identification and selection of concrete construction materials and equipment
- f) Concrete construction and finishing
- g) Formulation and check of the concrete construction plan
- h) Steel bar processing, connection, and installation
- i) Preparation of the steel bar construction scheme
- j) Monitoring of the water conservancy project and recording of the data
- k) Detection, inspection and maintenance of water conservancy project monitoring facilities
- l) Routine inspection and maintenance of hydraulic gate operation, abnormality identification and local maintenance, abnormality elimination, and equipment maintenance
- m) Observation and measurement of (test) precipitation, water level, and flow, and reorganization of data
- n) Hydrological survey, groundwater observation, and water quality monitoring
- o) Installation and maintenance of hydrological survey instruments and equipment, and hydrological information prediction
- p) Water conservancy and hydropower engineering construction management

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 WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIANS - NTA 5

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	EXCAVATING WATER INTAKE WELL	DUTY NO.	501
TASK TITLE	USING AND MAINTAINING COMMON DRILLING RIGS	TASK NO.	5011
PERFORMANCE CRITERIA	The person performing this task must be able to use and maintain common drilling rigs according to technical requirements.		
RANGE STATEMENT	<p>The task can be performed on the drilling site under the supervision of a Senior Technician or Geological Engineer.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Hydrological drilling rig; 2. Drill tools. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Follow safety, quality and environmental protection measures when performing this task; 2. Follow drilling construction procedures when performing this task; 3. Install drilling rig; 4. Check installation of drilling rig; 5. Check connecting bolts of drilling rig; 6. Check transmission parts of drilling rig; 7. Check lubrication of drilling rig; 8. Check oil leakage of drilling rig; 9. Operate clutch normally; 10. Operate clutch by inching; 11. Operate drilling rig with variable speed; 12. Operate drilling rig separately; 13. Lift drilling tool; 14. Lower drilling tool; 15. Brake drilling rig; 16. Operate drilling rig with micro-motion; 17. Adjust clearance of lifting mechanism; 18. Maintain drilling rig. 		<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Check drilling rig; 1.2 Use drilling rig; 1.3 Maintain drilling rig. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Safety, quality and environmental protection standards; 2.2 Drilling construction procedures. <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> 3.1 Main structure of drilling rig; 3.2 Working principles of drilling rig; 3.3 Using methods of drilling rig. <p>4.0 Essential Skills</p> <ol style="list-style-type: none"> 4.1 Communication skills; 4.2 Management skills; 4.3 Data storage skills; 4.4 Customer service skills; 	

	<p>4.5 Teamwork skills;</p> <p>4.6 Report writing skills;</p> <p>4.7 Computer operation skills.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	Use and maintain common drilling rigs according to the requirements of the regulations.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Work safety and management; 2. Engineering quality control; 3. Occupational health and safety; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	EXCAVATING WATER INTAKE WELL	DUTY NO.	501
TASK TITLE	TROUBLESHOOTING GENERAL MECHANICAL PROBLEMS	TASK NO.	5012
PERFORMANCE CRITERIA	The person performing this task must be able to troubleshoot general mechanical problems according to technical requirements.		
RANGE STATEMENT	<p>The task can be performed on the drilling site under the supervision of a Senior Technician or Geological Engineer.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Hydrological drilling rig; 2. Mud pump; 3. Drilling tower; 4. Air compressor; 5. Shaft-forming pipes. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Follow safety, quality and environmental protection measures when performing this task; 2. Choose correct tools, equipment and safety protection articles for tasks; 3. Troubleshoot main faults of drilling rig; 4. Troubleshoot main faults of reciprocating pump; 5. Troubleshoot main faults of diesel engine; 6. Troubleshoot main faults of motor. 		<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Troubleshoot main faults of drilling rig; 1.2 Troubleshoot main faults of reciprocating pump; 1.3 Troubleshoot main faults of diesel engine; 1.4 Troubleshoot main faults of motor. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Troubleshooting of general mechanical problems. <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> 3.1 Main faults of drilling rig; 3.2 Main faults of reciprocating pump; 3.3 Main faults of diesel engine; 3.4 Main faults of motor. <p>4.0. Essential Skills</p> <ol style="list-style-type: none"> 4.1 Communication skills; 4.2 Management skills; 4.3 Data storage skills; 	

	<p>4.4 Customer service skills;</p> <p>4.5 Teamwork skills;</p> <p>4.6 Drilling rig operation skills;</p> <p>4.7 Tool and equipment use and maintenance skills.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	Install and form the drilling rig according to the requirements of the regulations.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Work safety and management; 2. Engineering quality control; 3. Occupational health and safety; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	OPERATING COMMON TYPES OF DRILLING RIGS	DUTY NO.	501
TASK TITLE	REPAIRING FAULTS OF DRILLING TOOLS	TASK NO.	5013
PERFORMANCE CRITERIA	The person performing this task must be able to repair drill pipe failures in accordance with technical requirements.		
RANGE STATEMENT	<p>The task can be performed on the drilling site under the supervision of a Chief Engineer or Leader in charge.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Hydrological drilling rig; 2. Mud pump; 3. Drilling tower; 4. Air compressor; 5. Borehole inclinometer; 6. Shaft-forming pipes. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Follow safety, quality and environmental protection measures when performing this task; 2. Choose correct tools, equipment and safety protection articles for tasks; 3. Judge faults of drilling tools; 4. Repair faults of drilling tool. 		<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Judge faults of drilling rig; 1.2 Repair faults of drilling tool. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Drilling construction procedures; 2.2 Safety, quality and environmental protection standards; <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> 3.1 Abnormal phenomena; 3.2 Causes of abnormal phenomena; 3.3 Handling methods of drilling tools. <p>4.0. Essential Skills</p> <ol style="list-style-type: none"> 4.1 Communication skills; 4.2 Management skills; 	

	<p>4.3 Data storage skills;</p> <p>4.4 Customer service skills;</p> <p>4.5 Teamwork skills;</p> <p>4.6 Report writing skills.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	Repair the drilling tool faults according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Work safety and management; 2. Engineering quality control; 3. Occupational health and safety; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	EXCAVATING WATER INTAKE WELL	DUTY NO.	501
TASK TITLE	DEALING WITH GENERAL DOWN-HOLE TROUBLES	TASK NO.	5014
PERFORMANCE CRITERIA	The person performing this task must be able to deal with more serious down-hole trouble according to technical requirements.		
RANGE STATEMENT	<p>The task can be performed on the drilling site under the supervision of a Chief Engineer or Leader in charge.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Die tap and die collar; 2. Catch sleeve; 3. Fishing spear; 4. Cutting knife; 5. Mill; 6. Grappling basket; 7. Lifter. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Follow safety, quality and environmental protection measures when performing this task; 2. Choose correct tools, equipment and safety protection articles for tasks; 3. Check drilling equipment for obvious faults; 4. Check the hole for factors affecting the drilling rig; 5. Identify accurate location of accident and current situation of the hole; 6. Propose feasible solutions; 7. Deal with general down-hole troubles. 		<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Deal with general down-hole troubles. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Handling of down-hole troubles; 2.2 Safety, quality and environmental protection standards. <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> 3.1 Orders of dealing with general down-hole troubles; 3.2 Methods of dealing with general down-hole troubles; 3.3 Essentials of dealing with general down-hole troubles; 3.4 Project quality indexes and work safety measures. <p>4.0 Essential Skills</p>	

	<ul style="list-style-type: none"> 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Deal with the general down-hole trouble according to technical requirements
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ul style="list-style-type: none"> 1. Work safety and management; 2. Engineering quality control; 3. Occupational health and safety; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	DUTY NO.	502
TASK TITLE	USING AND PROTECTING EARTHWORK EXCAVATION EQUIPMENT	TASK NO.	5021
PERFORMANCE CRITERIA	The person performing this task must be able to properly use the earthwork excavation equipment and take the necessary safety precautions according to technical requirements.		
RANGE STATEMENT	<p>The task can be performed on the water conservancy and hydropower construction site under the supervision of a Senior Technician or Water Conservancy and Hydropower Engineer.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Bulldozer; 2. Excavator. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Select the required machinery according to the engineering needs; 2. Operate the selected machinery according to engineering needs; 3. Identify the excavation sequence layout plan; 4. Determine the location and size of earthwork excavation; 5. Set warning signs before mechanical excavation; 6. Check the solidity of the mechanical excavation components; 7. Clear the obstacles in the construction area; 8. Forbid people to stand within the rotation radius of the excavator; 9. Excavate the earthwork in the correct order of excavation and ensure safety; 10. Clean up the surface of the machine; 11. Sort excavation machines in an orderly manner. 		<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Operate Normally bulldozers to clear obstacles in the construction area; 1.2 Operate Normally excavator to excavate earthwork. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Quality requirements for mechanical excavation of earthwork; 2.2 Basic requirements for the safe operation of mechanical construction sites. <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> 3.1 Operational requirements for bulldozers to clear obstacles; 3.2 Sequence and operational requirements for excavator to excavate earthwork. <p>4.0 Essential Skills</p> <ol style="list-style-type: none"> 4.1 Communication skills; 	

	<p>4.2 Operation skills;</p> <p>4.3 Teamwork skills.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	Operate and maintain the earthwork excavation equipment.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Operational specifications of construction machines; 2. Safety measures setting for earthwork excavation; 3. Environmental and occupational health.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	DUTY NO.	502
TASK TITLE	OPERATING AND MAINTAINING EARTHWORK TRANSPORTATION EQUIPMENT	TASK NO.	5022
PERFORMANCE CRITERIA	The person performing this task must be able to properly use the earthwork transportation equipment and take the necessary safety precautions according to technical requirements.		
RANGE STATEMENT	<p>The task can be performed on the water conservancy and hydropower construction site under the supervision of a Senior Technician or Water Conservancy and Hydropower Engineer.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Dump truck; 2. Excavator; 3. Loader. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Choose the required machines according to the engineering needs; 2. Operate the selected machines according to the engineering needs; 3. Identify the roadmap of earthwork transportation and the layout of the material yard; 4. Determine the quantity of earthwork transportation and transportation distance; 5. Choose suitable transportation equipment and inspect it before earthwork transportation; 6. Inspect the safety of earthwork loading equipment and alert area; 7. Carry out earthwork transportation according to the correct process and ensure safety; 8. Clean up the surface of transportation machines; 9. Sort the transportation machines in an orderly manner. 		<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Normally operate the loading equipment workflow; 1.2 Normally operate the transportation equipment workflow. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Basic requirements for the reasonable configuration of earthwork transportation equipment; 2.2 Basic requirements for the safe operation of transportation sites. <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> 3.1 Basic operational procedures and construction specifications for earthwork transportation; 3.2 Sequence and operational requirements for earthwork transportation equipment. <p>4.0 Essential Skills</p>	

	<p>4.1 Communication skills;</p> <p>4.2 Operation skills;</p> <p>4.3 Teamwork skills.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	Operated and maintained the earthwork transportation equipment is properly operated and maintained.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Operational specifications of transportation machines; 2. Safety measures setting for earthwork transportation; 3. Environmental and occupational health.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	DUTY NO.	502
TASK TITLE	OPERATING AND MAINTAINING EARTHWORK ROLLING EQUIPMENT	TASK NO.	5023
PERFORMANCE CRITERIA	The person performing this task must be able to properly use the earthwork rolling equipment and take the necessary safety precautions according to technical requirements.		
RANGE STATEMENT	<p>The task can be performed on the water conservancy and hydropower construction site under the supervision of a Senior Technician or Water Conservancy and Hydropower Engineer.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Smooth-wheel roller; 2. Ribbed roller or sheep-foot roller; 3. Vibratory roller; 4. Pneumatic tired roller; 5. Rammer. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Choose the required machines according to the engineering needs; 2. Operate properly the machines according to the engineering needs; 3. Select properly the compaction parameters according to the engineering profile; 4. Select correctly the running mode of rolling machines according to the engineering profile; 5. Carry out safety inspection on machines and equipment; 6. Carry out routine maintenance of machines and equipment. 		<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Standardize the selection process of rolling machinery (equipment); 1.2 Standardize the operational process of rolling machinery (equipment); 1.3 Standardize the operational process of rolling machinery (equipment) running mode; 1.4 standardize the operational process of rolling machinery (equipment) safety inspection; 1.5 Standardize the operational process of rolling machinery (equipment) routine maintenance. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Basic requirements for the reasonable configuration of earthwork rolling machinery (equipment); 2.2 Basic requirements for the safety operation of rolling machinery (equipment) on the site. <p>3.0 Theories</p>	

	<p>The person performing this task must be able to explain the following:</p> <p>3.1 Basic operational procedures and construction specifications for earthwork rolling;</p> <p>3.2 Sequence and operating requirements of earthwork rolling machinery (equipment).</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Operation skills;</p> <p>4.3 Teamwork skills.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	Operated and maintain the earthwork rolling equipment properly.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <p>1. Operations specifications of mechanical equipment;</p> <p>2. Safety measures setting for earthwork rolling;</p> <p>3. Environmental and occupational health.</p>

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	DUTY NO.	502
TASK TITLE	MANUFACTURING AND MIXING READY-MIXED CONCRETE	TASK NO.	5024
PERFORMANCE CRITERIA	The person performing this task must be able to manufacture and mix concrete and perform quality control.		
RANGE STATEMENT	<p>The task can be performed on the water conservancy and hydropower construction site under the supervision of a Senior Technician or Water Conservancy and Hydropower Engineer.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Concrete manufacturing facilities 2. Concrete mixer; 3. Slump tester. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Control the processes of measurement and mixing of concrete constituent materials, concrete quality inspection, transportation, etc.; 2. Inspect whether the main production equipment for concrete conforms to the current national standards, and inspect whether concrete mixing equipment, placing equipment, machines and tools are in good condition; 3. Inspect whether the raw materials used in production, concrete design intensity level, concrete production mix ratio, engineering name and parts are compatible; 4. Adjust the concrete production according to the records of weather, production and inspection; 5. Inspect whether the collapse and cohesiveness meet the mix ratio or the requirements specified in the contract. All parties participating in the witness shall sign and file the opening identification record; 6. Record and print the mix ratio for concrete production, and conduct random inspection, verification and production records by the project manager and supervising engineer; 7. Adopt statistical methods of quality management. 		<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Make the preparations before concrete production; 1.2 Judge the quality identification of concrete during production and its recording; 1.3 Make the preparation of concrete for transportation work after production. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Quality requirements for the production of concrete; 2.2 Safety requirements for production of machinery. <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> 3.1 Using methods and operating procedures of production machinery; 3.2 Equipment requirements for different properties of concrete; 3.3 Concrete mix ratio calculations and their precautions; 	

<p>gement to conduct regular statistical analysis and guide subsequent production;</p> <p>8. Keep mixing equipment, metering equipment and its auxiliary equipment in a clean and normal operating condition.</p>	<p>3.4 Quality control during concrete pouring;</p> <p>3.5 Collection and organization of concrete instructional materials.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Management skills;</p> <p>4.3 Teamwork skills;</p> <p>4.4 Calculation skills.</p>
<p>DESCRIPTION OF THE END PRODUCT / SERVICE</p>	<p>Clarify technical requirements such as concrete production equipment, mixing equipment and quality control.</p>
<p>CIRCUMSTANTIAL KNOWLEDGE</p>	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Representing methods of concrete intensity grades; 2. Identification of the cohesiveness and water retention of concrete mixes; 3. Occupational health, safety and construction environment protection.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	DUTY NO.	502
TASK TITLE	READING DRAWINGS, AND DETAILING AND TRIMMING CONCRETE FORMWORK	TASK NO.	5025
PERFORMANCE CRITERIA	The person performing this task must be able to read drawings, and detail and trim concrete formwork.		
RANGE STATEMENT	<p>The task can be performed on the water conservancy and hydropower construction site under the supervision of a Senior Technician or Water Conservancy and Hydro power Engineer.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Tower Crane; 2. Hammer; 3. Wrench. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Read the engineering plan and section drawing and carry out the formwork detailing; 2. Install the formwork according to the engineering drawings, ensure tight joints, smooth surface and brush isolating agent; 3. Ensure adequate load-bearing capacity, stiffness and stability of the formwork and its supports to withstand the weight, lateral pressure and construction load of the poured concrete; 4. Carry out formwork acceptance prior to concrete placement, observe and maintain the formwork and its supports during formwork installation and concrete placement; 5. Install and trim the complex formwork; 6. Remove the formwork in the order of principle: first remove after support, and first support after removal. 		<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Determine the accuracy of reading engineering drawings; 1.2 Determine the sequence of formwork detailing and installation; 1.3 Determine the quality of formwork construction; 1.4 Formulate formwork removal and trimming plan. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Specifications for the construction of concrete formwork installation; 2.2 Specifications for the construction of concrete formwork removal; <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> 3.1 Steps of engineering drawing; 3.2 Technical points of structural construction drawings; 	

	<p>3.3 Identification of construction site hazards;</p> <p>3.4 Steps and precautions for formwork removal and trimming.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Management skills;</p> <p>4.3 Teamwork skills.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	Complete quality control for formwork installation, trimming and removal.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Formwork installation; 2. Formwork trimming; 3. Formwork removal.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	DUTY NO.	502
TASK TITLE	CHECKING AND ACCEPTING THE QUALITY OF READY-MIXED CONCRETE	TASK NO.	5026
PERFORMANCE CRITERIA	The person performing this task must be able to check and accept, maintain and repair ready-mixed concrete.		
RANGE STATEMENT	<p>The task can be performed on the water conservancy and hydropower construction site under the supervision of a Senior Technician or Water Conservancy and Hydropower Engineer.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Slump tester; 2. Concrete extensibility tester; 3. Pressure tester. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Verify the accompanying Delivery Note for each mixer truck; 2. Test the collapse (or expansion) of the concrete; 3. Choose and determine the maintenance methods for special concrete and special component concrete; 4. Maintain special concrete and special component concrete according to the special programme; 5. Identify the causes of concrete defects; 6. Repair all types of concrete defects as required by the work procedures. 		<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Test the collapse and expansion of the concrete; 1.2 Maintain the concrete; 1.3 Judge the quality of concrete. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Quality control principles of concrete acceptance; 2.2 Rigorous principle of concrete testing. <p>3.0 Methods</p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> 3.1 Concrete slump and expansion test methods; 3.2 Intensity grade codes and mix ratios of ready-mixed concrete; 3.3 Factors affecting the various methods of concrete maintenance; 3.4 Judgment methods for the quality of concrete maintenance. <p>4.0 Essential Skills</p>	

	<p>4.1 Communication skills;</p> <p>4.2 Management skills;</p> <p>4.3 Teamwork skills.</p> <p>5.0 Mathematical skills</p> <p>5.1 Sampling method.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	Accept the concrete in accordance with the technical requirements, and maintained and repaired the concrete.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Mechanical properties of materials; 2. Statistical analysis of experimental data.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	DUTY NO.	502
TASK TITLE	READING GENERAL COMPONENT REINFORCEMENT DRAWINGS	TASK NO.	5027
PERFORMANCE CRITERIA	The person performing this task must be able to understand general component drawings, construction schemes according to technical requirements.		
RANGE STATEMENT	<p>The task can be performed on the water conservancy and hydropower construction site under the supervision of a Water Conservancy and Hydropower Engineer or Civil Engineer.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Measuring and marking tools: tape measure, angle ruler, pencil, ruler, chalk, etc. 2. Safety protection equipment: safety belt, helmet, gloves, ear plugs, safety shoes, etc. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE	UNDERPINNING KNOWLEDGE		
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Recognize the structural construction drawings of frames, shear walls, mixed structures, etc.; 2. Recognize the prefabricated component reinforcement drawings; 3. Recognize the construction scheme of reinforcement works; 4. Lay out the reinforcement for simple support beam, slab, structural column and other simple components. 	<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Recognize various structural construction drawings and prefabricated component reinforcement drawings, and lay out reinforcement for simple components. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Symbolic representation and construction methods of structural construction drawings; 2.2 Mechanical properties of different types of structures; 2.3 Properties and usage of various construction components. <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> 3.1 Structural mechanics; 3.2 Structural design of reinforced concrete; 3.3 Theoretical knowledge related to construction techniques. 		

	<p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Management skills;</p> <p>4.3 Teamwork skills.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	Reasonable connection and reinforcement of components are ensured through the reading of structural construction drawings, prefabricated component reinforcement drawings and reinforcement engineering construction schemes, and the placement of reinforcement lines, etc., and the ultimate purpose of ensuring the safety and stability of the building structure is achieved.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Basic knowledge of structural construction drawing recognition; 2. General construction knowledge of prefabricated components; 3. Relationship of reinforcement position between connection nodes of components; 4. Structural knowledge of beams, slabs, columns, walls and general stairs.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	DUTY NO.	502
TASK TITLE	CONNECTING THE THREAD, SOCKET EXTRUSION JOINT	TASK NO.	5028
PERFORMANCE CRITERIA	The person performing this task must be able to connect the thread, socket extrusion joint according to technical requirements.		
RANGE STATEMENT	<p>The task can be performed on the water conservancy and hydropower construction site under the supervision of a Water Conservancy and Hydropower Engineer or Civil Engineer.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Processing equipment such as reinforcement shear, steel bar bender, CNC processing equipment, etc.; 2. Measuring tools such as reinforcement locator, caliper, straightedge and gauge, etc.; 3. Connecting equipment such as threading machine, socket extruder, etc.; 4. Hand-held tools such as hand-held electric drill, electric wrench, electric welding machine, etc.; 5. Connecting components such as rebar coupler, reinforcement welding material, reinforcement lap joint, etc.; 6. Personal protective equipment such as safety helmet, gloves, protective goggles, etc. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE	UNDERPINNING KNOWLEDGE		
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Carry out connections of tapered thread, straight thread and socket extrusion joints; 2. Carry out the reinforcement connection and assembly of conventional prefabricated components. 	<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Carry out thread processing and joint connection using tools such as torsion shears and chucking machines; 1.2 Carry out socket extrusion joint connections using tools such as hydraulic presses and extrusion machines; 1.3 Carry out reinforcement connection and assembly using bolts, rebar sockets, connection plates and other tools. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Principles of threaded connections; 2.2 Principles of socket extrusion joint connection; 		

	<p>2.3 Principles of reinforcement connection and assembly.</p> <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 Design and calculation principles of threaded connections and socket extrusion joint connections;</p> <p>3.2 Structural design and assembly principles of reinforcement connection and assembly.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Management skills;</p> <p>4.3 Teamwork skills;</p> <p>4.4 Safety consciousness.</p>
<p>DESCRIPTION OF THE END PRODUCT / SERVICE</p>	<p>Meet the intensity and stability requirements of the building structure after the reinforcement is connected and assembled; The stability and safety of the building structure are ensured by the connection of threaded and socket extrusion joints.</p>
<p>CIRCUMSTANTIAL KNOWLEDGE</p>	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. General knowledge of relevant structural reinforcement and structural requirements; 2. Knowledge of reinforcement mechanical connection; 3. Knowledge of reinforcement mechanical joint sampling retest.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	DUTY NO.	502
TASK TITLE	TYING, INSTALLING AND FIXING REINFORCEMENT MESH AND FRAMEWORK	TASK NO.	5029
PERFORMANCE CRITERIA	The person performing this task must be able to tie, install and fix reinforcement mesh and framework according to technical requirements.		
RANGE STATEMENT	<p>The task can be performed on the water conservancy and hydropower construction site under the supervision of a Water Conservancy and Hydropower Engineer or Civil Engineer.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> 1. Steel bar processing machine, used for cutting, bending, and cold machining of steel bars; 2. Electric welding machine, used for welding steel bars; 3. Measuring tools, such as tape and protractor, used for measuring and marking steel bars; 4. Hand tools, such as hammers, pliers and wrenches, used for holding and fixing steel bars during processing and splicing; 5. Protective equipment, such as gloves, goggles and masks, used for protecting the safety and health of workers; 6. Vehicle-mounted lifting equipment, used for transporting and handling large steel bars. 		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
<p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> 1. Tie, install and fix the reinforcement mesh and framework; 2. Set up reinforcement limiters as required by the construction instructions; 3. Conduct self-inspection; 4. Inspect the quality of tying, positioning and fixing of reinforcement mesh and framework; 5. Adjust the reinforcement position; 6. Repair the displacement and deformation of reinforcement during construction. 		<p>Detailed knowledge about:</p> <p>1.0 Methods</p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> 1.1 Tie, install and fix the reinforcement mesh and framework; 1.2 Set up reinforcement limiters as required by the construction instructions; 1.3 Inspect the quality of tying, positioning and fixing of reinforcement mesh and framework; 1.4 Adjust the reinforcement position; 1.5 Repair the displacement and deformation of reinforcement during construction. <p>2.0 Principle</p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> 2.1 Principles of reinforcement tying; 2.2 Principles of reinforcement anchorage; 	

	<p>2.3 Principles of reinforcement node construction;</p> <p>2.4 Theory of reinforcement connection and installation quality.</p> <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 Requirements for anchorage and joint location of reinforcement;</p> <p>3.2 Knowledge of conventional reinforcement node construction;</p> <p>3.3 Knowledge of reinforcement connection and installation quality;</p> <p>3.4 Requirements for the setting of pads, plastic cards, support bars, etc.;</p> <p>3.5 Tying techniques and requirements for prefabricated reinforcement framework.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Management skills;</p> <p>4.3 Teamwork skills;</p> <p>4.4 Safety consciousness.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	The quality of tying, installation and fixing of reinforcement mesh and framework is ensured to meet national standards and project quality requirements.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Principles of reinforcement tying; 2. Principles of reinforcement anchorage; 3. Principles of reinforcement node construction; 4. Theory of reinforcement connection and installation quality.

TABLE 1: DACUM CHARTS FOR WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN - NTA 5

DUTIES	TASKS	ENABLERS
1.0 Excavating water intake wells	1.1 Using and maintaining common drilling rigs 1.2 Troubleshooting general mechanical problems 1.3 Repairing faults of drilling tools 1.4 Dealing with general down-hole troubles	<p>Generic skills and knowledge</p> <ul style="list-style-type: none"> • Application of communication skills to work with others and report to superiors • Use of drilling rig • Maintenance of drilling rig • Troubleshooting of general mechanical problems • Repair of drilling tool • Handling of general down-hole trouble • Knowledge of safety, quality and environmental protection • Interpretation of construction drawings • Occupational safety and health. <p>Tools and equipment</p> <ul style="list-style-type: none"> • Safety helmet, safety belt, work clothes, work shoes, gloves and other personal protective equipment • Fire safety equipment • Work safety signs • Lightning rod, drilling tower shed rope, hoist protection device, faucet guide rope, lifter protective screen and other safety protection facilities <p>Materials</p> <ul style="list-style-type: none"> • Water and mud <p>Requirements for employees</p> <ul style="list-style-type: none"> • Teamwork spirit • Integrity • Safety consciousness • Quality consciousness
2.0 Water conservancy project construction	2.1 Using and protecting earthwork excavation equipment 2.2 Operating and maintaining earthwork transportation equipment 2.3 Operating and maintaining earthwork rolling equipment	<p>General skills and knowledge:</p> <ul style="list-style-type: none"> • Calculative and statistical skills • Mechanical operation skills • Reinforcement, Concrete Materials Science • Interpretation of complex drawings • Construction surveying and setting-out • Completion of construction records

DUTIES	TASKS	ENABLERS
	2.4 Manufacturing and mixing ready-mixed concrete	<p>Tools and equipment</p> <ul style="list-style-type: none"> • Bulldozer • Excavator • Loader • Dump truck • Smooth-wheel roller • Ribbed roller or sheep-foot roller • Vibratory roller • Pneumatic tired roller • Rammer • Concrete pump • Concrete mixing station • Concrete spreader • Cutting machine • Torque wrench • Level gauge • Reinforcement cutting machine • Reinforcement bender • Thread processing equipment • Socket extrusion machine • Reinforcement tying tool • Fixing tool • Personal safety equipment <p>Materials</p> <ul style="list-style-type: none"> • Wood • Formwork • Cement • Grit • Gravel • Steel bar • Concrete • Steel bar mesh <p>Requirements for employees</p> <ul style="list-style-type: none"> • Have good communication ability • Have strong teamwork spirit and communication skills • Have good consciousness of safety and construction quality
2.5 Reading drawings, and detailing and trimming concrete formwork		
2.6 Checking and accepting the quality of ready-mixed concrete		
2.7 Reading general component reinforcement drawings		
2.8 Connecting the thread, socket extrusion joint		
2.9 Tying, installing and fixing reinforcement mesh and framework		