****

**REPUBLIC OF KENYA**

**COMPETENCY-BASED CURRICULUM**

**FOR**

**CONCRETE CONSTRUCTION FOREPERSON**

**LEVEL 5**

 

 TVET CDACC

 P.O. BOX 15745-00100

 NAIROBI

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**Council Secretary/CEO**

**TVET Curriculum Development, Assessment and Certification Council**

**P.O. Box 15745–00100**

**Nairobi, Kenya**

**Email: cdacc.tvet@gmail.com**

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya’s development blueprint, Vision 2030 and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution of Kenya of 2013.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum was developed.

It is my conviction that this Curriculum will play a great role towards development of competent human resource for the Construction sector’s growth and development.

**PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING**

**MINISTRY OF EDUCATION**

# PREFACE

Kenya Vision 2030 aims to transform the country into a newly industrializing, “middle-income country providing a high-quality life to all its citizens by the year 2030”. Kenya intends to create a globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through life-long education and training. TVET has a responsibility of facilitating the process of inculcating knowledge, skills and attitudes necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency Based Education and Training (CBET).

The Technical and Vocational Education and Training Act No. 29 of 2013, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Construction Sector Skills Advisory Committee (SSAC have developed this curriculum for Concrete Construction Foreperson.

I am grateful to the Council Members, Council Secretariat, Construction SSAC, expert workers and all those who participated in the development of this curriculum

**Prof. CHARLES M. M. ONDIEKI, PhD, FIET (K), Con. Eng Tech.**

**CHAIRMAN, TVET CDACC**

# ACKNOWLEDGMENT

This curriculum has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support was received from various organisations.

I appreciate the funding of the Government of Canada and its implementing partner Colleges and Institutes Canada (CICan) which enabled the development of this curriculum through the Kenya Education for Employment Program (KEFEP).

I also appreciate the Eldoret National Polytechnic and its Canadian technical partners from Algonquin College who collaborated to identify industry skills gaps and develop this curriculum.

I recognize with appreciation the role of industry partners including the National Polytechnic’s Industry Advisory Committee and the national Sector Skills Advisory Committee (SSAC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the sector for their valuable input and all those who participated in the process of developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that workers in this sector acquire competencies that will enable them to perform their work more efficiently.

**Dr. LAWRENCE GUANTAI M’ITONGA, PhD**

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

**KEY TO UNIT CODE**

 **ENG/CU/CON/BC/01/4/A**

Industry or sector

Curriculum

Occupational area

Type of competency

Competency number

Competency level

Version control

# COURSE DESCRIPTION

This course overview describes the competencies required for employment as a **CONCRETE CONSTRUCTION FOREPERSON, Level 5.** This course is designed to equip the trainee with the competencies, skills, and knowledge required to manage construction projects sites and supervise and direct surveyors, concrete workers, concrete field testers, and other workers related to Earthworks, Surfacing, Pavement, and Concrete Works.

**Units of Learning**

This course consists of basic and core units of learning as indicated below:

|  |
| --- |
| **Core Units of Learning** |
| **Unit of Learning Code** | **Unit of Learning Title** | **Duration in Hours\*** | **Credit Factor** |
| ENG/CU/CON/CR/01/5/A | Construction Surveying Site Preparation | 120  | 12 |
| ENG/CU/CON/CR/01/5/A | Construction Surveying Assistant | 120  | 12 |
| ENG/CU/CON/CR/02/5/A | Construction Surveyor | 120  | 12 |
| ENG/CU/CON/CR/03/5/A | Concrete Construction Assistant | 120  | 12 |
| ENG/CU/CON/CR/04/5/A | Concrete Construction Field Testing Assistant | 120  | 12 |
| ENG/CU/CON/CR/05/5/A | Concrete Construction Field Tester | 120  | 12 |
| ENG/CU/CON/CR/06/5/A | Assistant/Deputy Concrete Construction Foreperson  | 100 | 10 |
| ENG/CU/CON/CR/07/5/A | Concrete Construction Foreperson | 100 | 10 |
|  | Industry/Work Attachment | 600 | 600 |
| **Total** | **1520** | **152** |
| **Grand Total** | **1800** | **180** |

**\*Hours as noted are notional hours and include classroom, lab, self-study, and assignment time.**

**CORE COMPETENCIES**

**Surveying Competencies**

1. Conduct field surveys and operate survey instruments and computer equipment to measure distance, angles, elevations and contours.
2. Record and assist calculation, analysis and computation in the measurements and other information obtained during field survey activities.
3. Determine precise geographic locations using global positioning systems (GPS) equipment.
4. Analyze latitude, longitude, and angles and compute trigonometric and other calculations to plot features, contours and areas to a specific scale.
5. Keep records, measurements and other survey information in systematic order.
6. Assist in the preparation of detailed drawings, charts and plans.

**Concrete Field-Testing Competencies**

1. Test, inspect and determine good quality materials for concrete manufacture.
2. Prepare concrete products of various classes and standards using appropriate equipment, materials.
3. Record, calculate, analyze and compute measurements and other information obtained during concrete work activities.
4. Conduct unit conversions between systems of measure (metric and imperial).
5. Interpret and edit working drawings for the construction of various formworks and determine reinforcements for concrete works.
6. Conduct processes of concrete production including mixing, casting, jointing, testing, curing, consolidating and transporting in accordance with codes and job specifications.
7. Perform finishing techniques.

**Additional Competencies for Concrete Construction Foreperson**

1. Organize construction site efficiently and effectively.
2. Perform work plan and schedule activities.
3. Procure, receive and engage in proper store keeping.
4. Interpret and compute the schedule of materials from the bill of quantities.
5. Observe the relevant/applicable statutory obligations in day to day activities.
6. Exercise proper leadership (communication, delegation, supervision).

**Entry Requirements**

This course is designed for individuals who have completed both of the following certifications:

1. Construction Surveying Level 4

**Or**

b) Concrete Construction Field Testing Level 4

An individual entering this course with both of the previous certifications will receive credit for the 280 hours of basic units completed in either Construction Surveying Level 4 or Concrete Construction Field Testing Level 4 and 300 hours of work attachment completed in both, for a total of 600 work attachment hours, and will be required only to complete the Assistant/Deputy Concrete Construction Foreperson Unit and Concrete Construction Foreperson Unit, corresponding to the “Additional Competencies for Concrete Construction Foreperson” 14-19.

An individual without both of the previous certifications will need to first complete Construction Surveying Level 4 or Concrete Construction Field Testing Level 4. To be granted entry into either of those programs an individual should have any of the following minimum requirements:

1. Kenya Certificate of Secondary Education (KCSE): Mean Grade D (Plain)

**Or**

1. Equivalent qualifications as determined by Kenya National Qualifications Authority (KNQA)

**Assessment**

The course will be assessed at two levels: internally and externally. Internal assessment is continuous and is conducted by the trainer who is monitored by an accredited internal verifier while external assessment is the responsibility of TVET CDACC.

**Certification**

A candidate will be issued with a Record of Achievement for each unit of competency. To attain the qualification National Certificate Level 5 in Concrete Construction Foreperson, the candidate must demonstrate competence in all the units of competency as given in qualification pack. These certificates will be issued by TVET CDACC in conjunction with training provider.

# CORE UNITS OF LEARNING

# CONSTRUCTION SURVEYING SITE PREPARATION

**UNIT CODE:** ENG/CU/CON/CR/01/5/A

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**:

This unit addresses Core Competencies 2, 4, 5, and 6:

1. Record and assist calculation, analysis and computation in the measurements and other information obtained during field survey activities
2. Analyze latitude, longitude and angles and compute trigonometric and other calculations to plot features, contours and areas to a specific scale
3. Keep records, measurements and other survey information in systematic order
4. Assist in the preparation of detailed drawings, charts and plans

**DURATION OF UNIT:** 120 hours

**UNIT DESCRIPTION**

This unit describes the introductory competencies required by a CONSTRUCTION SURVEYOR in order to competently use a variety of survey tools and their application to surveying, field work and in-class discussion. Focus is on surveys in common use, levelling and survey control lines and in acquiring the skills and competencies required to assist a Construction Surveyor in preparing a construction site for surveying and, under the supervision of the Construction Surveyor or Surveyor Assistant, performing basic surveying tasks such as placing survey control lines.

**SUMMARY OF CORE COMPETENCY LEARNING OUTCOMES FOR SURVEYING I UNIT**

1. Explain basic survey terminologies and fundamentals
2. Identify surveys in common use
3. Operate a survey level for a variety of survey exercises
4. Calculate the directions of survey control lines

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Explain basic survey terminologies and fundamentals.

  | * Define terms used in surveying and describe various types of surveys in common use.
* Explain the objective of surveying.
* State the typical accuracy of engineering and explain differences between systematic and random errors.
* Locate distances a long a baseline.
* Apply units of measurement that are commonly used in metric and imperial systems.
* Calculate temperature correction for survey distances.
* Explain the procedure for applying corrections for a tape and relate the significance of random taping errors.
 | * Written exams/tests
* Group discussions
* Individual/group assignments
 |
| 1. Identify surveys in common use.
 | * Explain various types of surveys in common use.
* Describe and use tools and equipment used in survey operation.
* Demonstrate and carry out various surveys.
 | * Observation
* Individual/group presentations
* Group discussions
* Individual/group assignments
* Field practice
 |
| 3. Operate survey levels for a variety of survey exercises. | * Define terms used in levelling
* Explain tools and equipment used in levelling.
* Set up and operate a variety of survey levels as required for various exercise and testing.
* Outline the procedure of levelling and explain methods of reducing levels.
* Describe the meaning and significance, calculate and adjust arithmetic errors in surveying.
* Complete a set of level notes and graph results.
 | * Observation
* Field Records/Notes
 |
| 4. Calculate the directions of survey control lines.  | * Define and determine the direction of a survey line.
* Calculate the directions of survey lines in a closed survey
* Execute the standard check to ensure accuracy of results.
 | * Assignments
* Field practice
 |

**Suggested Delivery Methods**

* Practical demonstration of tasks by trainer
* Practice by trainees
* Observations and comments and corrections by trainers
* Trainer led facilitation of theory
* Group/individual presentations

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Organizational or external personnel
* Relevant professional/quality standards
* Instructional Equipment as follows:
	+ Overhead projector
	+ Projector Screen
	+ Instructor desktop PC
	+ Whiteboard(s)
* Tools and/or Equipment as follows:
* Electronic Distance Machine (EDM)
* Telescopic Leveling Rod/Staff
* Automatic Level
* Distance Measuring Wheel
* Hand Level
* Steel Band Measuring Tapes (10m,20m,30m,50m)
* Dumpy Level
* Ranging Rod
* Plumb Bob
* Field Notebook
* Surveying Marker Flags/Arrows
* Electronic Total Station Kit with Tripods
* Automatic Electronic Levels
* GPS Receiver
* Survey Compass
* Prismatic Compass
* Ranging Rod
* Levelling Staff
* Engineer's Multipurpose Tilting Level
* Robotic Total Stations
* Prism Pole
* Theodolite Kit
* Tripod
* Steel Band Tapes (10m,20m,30m, and 50m)
* Open Real Measuring Tapes
* Plotter
* Laptop
* AutoCAD/ArchiCAD or other relevant design software

# CONSTRUCTION SURVEYING ASSISTANT

**UNIT CODE:** ENG/CU/CON/CR/02/5/A

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**:

This unit addresses Core Competencies 1, 2, 3, 4, 5, and 6:

1. Conduct field surveys and operate survey instruments and computer equipment to measure distance, angles, elevations and contours
2. Record and assist calculation, analysis and computation in the measurements and other information obtained during field survey activities
3. Determine precise geographic locations using global positioning systems (GPS) equipment
4. Analyze latitude, longitude and angles and compute trigonometric and other calculations to plot features, contours and areas to a specific scale
5. Keep records, measurements and other survey information in systematic order
6. Assist in the preparation of detailed drawings, charts and plans

**DURATION OF UNIT:** 120 hours

**UNIT DESCRIPTION**

This unit describes the competencies required by a construction surveyor in order to competently demonstrate the practical application of survey theory and skills to the construction field. Successful completion of this unit will provide the skills and competencies required to assist a Construction Surveyor as a Construction Surveyor Assistant in the performance of more advanced surveying tasks such as curve ranging, traversing, and road-way elevations.

**SUMMARY OF LEARNING OUTCOMES**

1. Demonstrate an understanding of curve ranging, definition of terms and describe tools and equipment being used and perform calculations on curve ranging and super elevation.
2. Demonstrate an understanding of terms and tools used in traversing and perform calculations related to traversing,

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Demonstrate an understanding of curve ranging, definition of terms and describe tools and equipment being used and perform calculations on curve ranging and super elevation. | * Define various terms used in curve ranging.
* Explain the purpose of curve ranging.
* Describe tools and equipment’s for curve ranging.
* Outline and calculate data for curve ranging and explain various methods of overcoming obstacles in curve ranging.
* Calculate vertical curve elevations.
* Calculate spiral curve deflectations.
* Calculate road way super elevation.
 | * Exams/tests
* Individual/group assignments
 |
| 2. Demonstrate an understanding of terms and tools used in traversing and perform calculations related to traversing. | * Define terms used in traversing.
* Explain various instrumental methods of traversing.
* Describe and demonstrate various types of traversing.
* Execute field procedure of traversing.
* Explain the causes and adjustments of errors.
 | * Observation
* Field work
* Field work reports
 |

**Suggested Delivery Methods**

* Practical demonstration of tasks by trainer
* Practice by trainees
* Observations and comments and corrections by trainers
* Trainer led facilitation of theory

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals.
* Specific job procedures manuals
* Organizational or external personnel
* Relevant Quality standards
* Instructional Equipment as follows:
	+ Overhead projector
	+ Projector Screen
	+ Instructor desktop PC
	+ Whiteboard(s)
* Tools and/or Equipment as follows:
* Electronic Distance Machines (EDM)
* Telescopic Leveling Rod/Staff
* Automatic level
* Distance Measuring Wheels
* Hand Levels
* Steel Band Measuring Tapes(10m,20m,30m,50m)
* Dumpy Level
* Ranging rod
* Plumb Bob
* Field Notebook
* Surveying Marker Flags/Arrows
* Cross Staff/Optical Squares
* Electronic Total Station Kit with Tripods
* Automatic Electronic Levels
* Automatic Level
* GPS Receiver
* Survey Compass
* Prismatic Compass
* Ranging Rod
* Levelling Staff (digital)
* Engineer's Multipurpose Tilting Level
* Robotic Total Stations
* Prism Pole
* Theodolite Kit/Tachometer
* Tripod
* Open Real Measuring Tapes
* Telescopic Leveling Rod/Staff
* Laptop
* Plotter
* AutoCAD/ArchiCAD or other relevant design software

# CONSTRUCTION SURVEYOR

**UNIT CODE:** ENG/CU/CON/CR/03/5/A

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**:

This unit addresses Core Competencies 1, 4, 6:

* 1. Conduct field surveys and operate survey instruments and computer equipment to measure distance, angles, elevations and contours

4. Analyze latitude, longitude, and angles and compute trigonometric and other calculations to plot features, contours and areas to a specific scale

6. Assist in the preparation of detailed drawings, charts and plans.

**DURATION OF UNIT:** 120 hours

**UNIT DESCRIPTION**

This unit describes the competencies required by a CONSTRUCTION SURVEYOR in order to competently demonstrate the practical application of survey theory and skills to construction work. Topics include tachometry use of total stations earthworks, setting out works mapping and GPS. Trainees engage in summative project survey. Successful completion of this unit will provide the skills and competencies required to work in the field as a Construction Surveyor.

**SUMMARY OF LEARNING OUTCOMES**

1. Operate a theodolite in tachometry survey and operate and use a total station
2. Apply surveying skills to control works
3. Apply survey skills in setting out construction works
4. Operate GPS receiver and use AutoCAD to draw maps
5. Survey a section of the campus as directed and produce site plan of the area

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1.Operate a theodolite in tachometry surveys and operate and use a total station   | * Explain principles of tachometry.
* Describe and use tools and equipment.
* Outline the procedure of carrying out tachometry.
* Explain the key features and settings of the total station.
* Set up and operate the optical and digital levels compute accurate bench mark level loops and to set grades.
 | * Observation
* Field work
* Field work manuals
 |
| 2. Apply surveying skills to control works. | * Draw and interpret mass haul diagrams.
* Identify and use tools and equipment in control works.
* Calculate areas and volumes
 | * Assignments
* Tests
 |
| 3.Apply survey skills in setting out construction works | * Identify and operate tools and equipment required in setting out construction work.
* Outline the procedure and apply it in construction works to include verticality of building.
 | * Observation
* Field work - group
* Field work manuals - individual
 |
|  4.Operate GPS receiver and use AutoCAD to draw maps | * Explain properties of maps.
* State types of maps.
* Analyse interrelationships between scales.
* Use GPS receiver to determine horizontal coordinates of point.
 | * Observation
* Field work - group
* Field work manuals - individual
 |
| 5. Survey a section of the campus as directed and produce site plan of the area.   | * Use the total station to survey topographical data required
* Conduct a site reconnaissance of assigned compass area to identify object to be surveyed and site condition for planning the field work.
* Draw a detail site plan of the area on AutoCAD.
 | * Observation
* Field work – group
* Field work manuals - individual
 |

**Suggested Delivery Methods**

* Practical demonstration of tasks by trainer
* Field practice by trainees
* Observations and comments and corrections by trainers
* Trainer led facilitation of theory

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Organizational or external personnel
* Relevant professional/quality standards
* Instructional Equipment as follows:
	+ Overhead projector
	+ Projector Screen
	+ Instructor desktop PC
	+ Whiteboard(s)
* Tools and/or Equipment as follows:
	+ Electronic Total Station Kit with Tripods
	+ Automatic Electronic Levels
	+ Automatic Level
	+ GPS Receiver
	+ Survey Compass
	+ Prismatic Compass
	+ Ranging Rod
	+ Levelling Staff
	+ Engineer's Multipurpose Tilting Level
	+ Robotic Total Stations
	+ Prism Pole
	+ Theodolite Kit
	+ Tripod
	+ Steel Band Tapes (10m,20m,30m, and 50m)
	+ Open Real Measuring Tapes
	+ Field Notebook
	+ Laptop
	+ AutoCAD/ArchiCAD or other relevant software
	+ Electronic Distance Machine (EDM)
	+ Telescopic Leveling Rod/Staff
	+ Distance Measuring Wheel
	+ Hand Level
	+ Dumpy Level
	+ Plumb Bob
	+ Surveying Marker Flags/Arrows

# CONCRETE CONSTRUCTION ASSISTANT

**UNIT CODE:** ENG/CU/CON/CR/04/5/A

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**:

**This unit addresses Core Competencies 7, 8, 9, 10, 11, 12, and 13:**

7. Test, inspect and determine good quality materials for concrete manufacture.

8. Prepare concrete products of various classes and standards using appropriate equipment, materials.

9. Record and assist calculation, analysis and computation in the measurements and other information obtained during concrete work activities

10. Conduct unit conversions between systems of measure

11. Interpret working drawings for the construction of various formworks and determining reinforcements for concrete works.

12. Conduct processes of concrete production including mixing, casting, jointing, testing, curing, consolidating and transporting in accordance with codes and job specifications.

13. Perform finishing techniques.

**DURATION OF UNIT:** 120 hours

**UNIT DESCRIPTION**

This unit is designed to equip an individual with the competencies required for **CONCRETE FIELD TESTING** to competently demonstrate an understanding of and skills related to the physical characteristics and standard testing methods of materials, such as soils and aggregates, and is essential to students of concrete technician disciplines. Lectures are reinforced with labs to provide a foundational level of competence in the vocabulary and vocational skills related to materials used in construction projects. Students learn about strength of materials testing, as well as standard sieve, compression and proctor testing methods. Successful completion of this unit will provide the skills and competencies required, under the supervision of a Concrete Field-Testing Technician, to undertake basic concrete construction tasks such as soil and aggregate classification, preparing concrete mixes, and pouring.

**SUMMARY OF CORE COMPETENCY LEARNING OUTCOMES FOR CONCRETE CONSTRUCTION FIELD TESTING I UNIT**

1. Work with, and to undertake, computations in both the imperial and metric systems of measure and to perform unit conversions within and between the two systems
2. Explain the origins of rock and the formation of soil deposits
3. Convey (numerically) the physical state of a soil through its index properties
4. Classify a soil according to grain size
5. Determine and express (numerically) the properties of soils
6. Describe basic concrete fundamentals and terminology

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Work with, and to undertake, computations in both the imperial and metric systems of measure and to perform unit conversions within and between the two systems
 | * Express the fundamental units associated with the Imperial and Metric Systems along with the standard prefixes used to denote order of magnitude.
* Perform unit conversion within and between systems of measure using first principles.
* Measure volume, weight, and density of various materials, and to express them in Imperial and Metric units through formal unit conversion.
 | * Observation
* Group Work
* Tests
* Assignments
* Lab Exercise
 |
| 1. Explain the origins of rock and the formation of soil deposits.
 | * Identify and distinguish the characteristics of igneous, sedimentary and metamorphic rocks and to explain the weathering of rock and the formation of soil deposits.
* Distinguish and explain the differences among finer, cohesive and coarser, non-cohesive soils
 | * Tests
* Examinations
 |
| 1. Convey (numerically) the physical state of a soil through its index properties.
 | * Determine the weight/volume of air, water and solid constituents of a given soil with the aid of a phase diagram and to subsequently express (numerically) the index properties of a soil.
 | * Lab tests
* Observations
 |
| 1. Classify a soil according to grain size.
 | * Determine the particle size distribution of a soil by sieve testing and express the results graphically in the form of a grain size distribution curve.
* Express variation in particle size concisely in the form of the Uniformity Coefficient and the Coefficient of Curvature, and to compute the Fineness Modulus of an aggregate.
* Classify a soil according to grain size and soil mixtures using the textural classification chart of the American Concrete Institute (ACI)
 | * Lab Testing
 |
| 1. Determine and express (numerically) the properties of soils.
 | * Perform the standard laboratory permeability tests on soil and express the results in the form of the Coefficient of Permeability.
* Perform a standard pumping test on soil and express the results in the form of the Coefficient of Permeability and Shear.
* Perform Field Compaction factor test
* Determine Plasticity Index
 | * Lab Testing
 |
| 1. Describe basic concrete fundamentals and terminology
 | * Outline the basic materials used to produce concrete, and their approximate percentages. Outline the advantages and limitations of concrete as a building material.
* State the types of Portland cement commonly used, and describe a typical application for each.
* Describe the properties of finished concrete which are affected by the water to cement ratio.
 | * Tests
* Examinations
* Assignments
 |

**Suggested Delivery Methods**

* Practical demonstration of tasks by trainer
* Practice by trainees
* Observations and comments and corrections by trainers
* Trainer led facilitation of theory
* Group assignments
* Individual assignments

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Organizational or external personnel.
* Relevant professional/quality standards
* Instructional Equipment as follows:
	+ Overhead projector
	+ Projector Screen
	+ Instructor desktop PC
	+ Whiteboard(s)
* Tools and Equipment as follows:
* Set of Sieves
* Compression testing Machine
* Molds
* Slump Test Apparatus
* Mechanical Sieve Shaker
* Drying Oven
* Concrete Mixer
* Poker Vibrator
* In-situ water permeable test kit
* Concrete cover meter
* Bulk density kit
* Coarse aggregate density test set
* Dunagan test set
* Organic impurities test set
* Los Angeles abrasion machine
* Impact testing machine
* Hand operated casagrande equipment
* Motorized casagrande equipment
* Iso 200mm test set
* Soil hydrometers
* Consolidation apparatus
* Soil volume change meter
* Concrete poker vibrator
* Gauge rods
* Chapman flask % voids in aggregates
* Coarse aggregate density test set

 Soil permeable apparatus

* Plastic limit roller
* Overhead projector
* Desktop or lap top computer
* White board, markers, erasers

# CONCRETE FIELD-TESTING ASSISTANT

**UNIT CODE:** ENG/CU/CON/CR/05/5/A

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**:

This unit addresses Core Competencies 7, 8, 9, 11, 12, and 13:

1. Test, inspect and determine good quality materials for concrete manufacture.
2. Prepare concrete products of various classes and standards using appropriate equipment, materials.
3. Record and assist calculation, analysis and computation in the measurements and other information obtained during concrete work activities
4. Interpret working drawings for the construction of various formworks and determining reinforcements for concrete works.
5. Conduct processes of concrete production including mixing, casting, jointing, testing, curing, consolidating and transporting in accordance with codes and job specifications.
6. Perform concrete mix and finishing techniques.

**DURATION OF UNIT:** 120 hours

**UNIT DESCRIPTION**

This unit is designed to equip an individual with the competencies required for CONCRETE FIELD TESTING to competently demonstrate an understanding of and skills related to the physical characteristics and standard testing methods of materials, such as concrete, asphalt, steel and wood and is essential to students of concrete field testing and concrete works. Students attend lectures and labs that provide a more advanced level of competence in the vocabulary and vocational skills related to materials used in construction projects. Successful completion of this unit will provide the skills and competencies required to assist a Concrete Field Testing Technician in more advanced tasks such as concrete field testing, erection of formwork construction, analysis of aggregates, and application of weather/climate specific curing techniques.

**SUMMARY OF CORE COMPETENCY LEARNING OUTCOMES FOR CONCRETE CONSTRUCTION FIELD TESTING II UNIT**

1. Carry out basic laboratory tests and related calculations for concrete aggregates
2. Complete a concrete mix design
3. Describe basic wood fundamentals and terminology
4. Erect and strike formwork construction
5. Determine methods of concreting in adverse weather conditions

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Carry out basic laboratory tests and related calculations for concrete aggregates
 | * Complete a sieve analysis of the fine and coarse concrete aggregate. Plot the test results and the aggregate grading limits, and determine graphically if the aggregates meet specifications.
* Calculate the dry rodded unit weight of the concrete coarse aggregate and the fineness modulus of the fine aggregate. Determine whether the dry rodded unit weight and the fineness modulus of the aggregates meet specifications for concrete production.
* Calculate the % of voids present in the lab aggregate samples, and calculate the amount of cement paste required to produce concrete.
* Calculate the moisture content of the concrete fine and coarse aggregates, and make appropriate adjustments to reduce the concrete mix water requirements.
* Calculate the maximum allowable size of aggregate in a concrete mix to cast a structural element such as a concrete beam, based on the beam dimensions and the number and size of steel reinforcing bars.
* Cast a concrete beam based on the specifications provided. Test the beam for tensile strength by loading at mid-span until failure.
* Mix concrete based on the mix design provided, cast test cylinders and place in a water bath to be moist cured. Perform standard concrete tests during the casting such as slump test and concrete unit weight.
* Cap the concrete test cubes when hardened. Test the cubes for compressive strength in MPa at standard curing times of 7, 14, and 28 days.
* Outline the conclusions which can be drawn from the compressive strength testing data with respect to strength vs. water to cement ratio, and strength vs. time of moist curing. Use the available data from all groups, and graph the results in order to draw conclusions. Use a spreadsheet to carry out calculations and graphing.
 | * Lab assignments
* Tests
* Quizzes
* Examination
* Group assignments and testing
 |
| 1. Complete a concrete mix design
 | * Design a concrete mix to calculate the quantities in kg. for water, cement, coarse aggregate and fine aggregate to produce one cubic meter of concrete.
* The mix design quantities are to be based on the proposed concrete use, and the material specifications which are provided.
 | * Tests
* Lab Assignments
* Quizzes
 |
| 1. Describe basic wood fundamentals and terminology
 | * Outline the advantages and limitations of wood as a building material.
* Outline measures which can be taken to lessen the environmental impact of harvesting wood for use as a building material.
* Outline the species of wood most often used for building materials, and the most common grades of lumber available.
* Describe three ways in which the strength of wood is typically measured, and describe how the strength is affected by the grain.
* Describe the advantages of engineered wood products, and compare the strength of conventional lumber to engineered wood.
 | * Group lab assignments
* Quizzes
* Observation
 |
| 1. Erect and strike formwork construction
 | * Outline procedures of erecting formwork
* Determine sizes of formwork
* Select sizes of formwork materials
* Construction of formwork
* Striking formwork
 | * Group discussions
* Individual/group assignments
 |
| 1. Construct joints in concrete works
 | * Demonstrate the construction of joints used in concrete work
* Outline the processes of forming various types of joints
* Identify appropriate positions for a construction joint
 | * Quizzes
 |
| 1. Determine methods of concreting in adverse weather conditions
 | * Perform concreting tasks in adverse weather conditions
* Apply hot weather curing techniques in concrete works
 | * Discussion
* Tests
 |

**Suggested Delivery Methods**

* Practical demonstration of tasks by trainer
* Practice by trainees.
* Observations and comments and corrections by trainers
* Instructor led facilitation of theory

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Client/supplier instructions
* Organizational or external personnel
* Relevant professional/quality standards
* Instructional Equipment as follows:
	+ Overhead projector
	+ Projector Screen
	+ Instructor desktop PC
	+ Whiteboard(s)
* Tools and Equipment as follows:
* Compression testing Machine
* Molds
* Slump Test Apparatus
* Drying Oven
* Concrete Mixer
* Poker Vibrator
* In-situ water permeable test kit
* Concrete cover meter
* Bulk density kit
* Coarse aggregate density test set
* Dunagan test set
* Organic impurities test set
* Los Angeles abrasion machine
* Digital point load tester
* Impact testing machine
* Field CBR equipment
* CBR test machine (hand operated)
* Soil hydrometers
* Consolidation apparatus
* Soil volume change meter
* Plate bearing test machine
* Core cutter
* Concrete poker vibrator
* Gauge rods
* Chapman flask % voids in aggregates
* Coarse aggregate density test set
* Length gauge
* Automatic mechanical soil compactor
* Soil permeable apparatus
* Motorized CBR machine
* Cone penetrometer
* Plastic limit roller

# CONCRETE FIELD TESTER

**UNIT CODE:** ENG/CU/CON/CR/06/5/A

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**

**This units addresses Core Competencies 1, 2, 3, 4, 5, and 6:**

1. Test, inspect and determine good quality materials for concrete manufacture
2. Prepare concrete products of various classes and standards using appropriate equipment, materials.
3. Record and assist calculation, analysis and computation in the measurements and other information obtained during concrete work activities
4. Conduct unit conversions between systems of measure
5. Interpret working drawings for the construction of various formworks and determining reinforcements for concrete works.
6. Conduct processes of concrete production including mixing, casting, jointing, testing, curing, consolidating and transporting in accordance with codes and job specifications.

**DURATION OF UNIT:** 120 hours

**UNIT DESCRIPTION**

This unit is designed to equip an individual with the competencies required for CONCRETE FIELD TESTING to competently demonstrate an understanding of and skills related to the design and production and testing of reinforced concrete. Students will be introduced to and develop skills and knowledge of how the design of reinforced concrete elements of a structure is carried out including slabs, simple and continuous beams, and the selection and placement of reinforcing steel. Successful completion of this unit will provide all of the skills and competencies required to work as a Concrete Field Testing Technician.

**SUMMARY OF CORE COMPETENCY LEARNING OUTCOMES FOR CONCRETE CONSTRUCTION FIELD TESTING III UNIT**

1. Describe basic steel fundamentals and terminology
2. Know the individual and composite, mechanical properties of concrete and steel reinforcement.
3. Express the composite action of a reinforced concrete section subjected to direct compression.
4. Demonstrate an understanding of the behaviour, and the method of analysis, of reinforced concrete members subjected to bending.
5. Demonstrate an understanding of the behaviour of reinforced concrete columns under load and the method of analysis for evaluating ultimate capacity
6. Demonstrate an understanding of how reinforced concrete is being modified to lower its environmental impact

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Describe basic steel fundamentals and terminology
 | * Outline the production of iron using the blast furnace, and outline the manufacture of steel using the basic oxygen furnace and the electric arc furnace.
* Outline the advantages and limitations of steel as a building material. Describe the importance of controlling the carbon content of steel.
* Describe examples of modifying steel properties using alloys.
* Complete stress-strain calculations and graph the stress-strain curve for a steel sample, given data on steel sample dimensions, loading and deflection. Use a spreadsheet for calculations and graphing.
 | * Test
* Examinations
* Lab Tests
 |
| 1. Know the individual and composite, mechanical properties of concrete and steel reinforcement.
 | * Evaluate the strength and stiffness of plain concrete in accordance with CSA.
* Describe the types, grades and method of identification of steel reinforcement
 | * Group lab work
* Lab tests
* Lab reports
 |
| 1. Express the composite action of a reinforced concrete section subjected to direct compression.
 | * Describe the concept of relative stiffness between steel and concrete expressed in terms of the modular ratio.
* Determine and work with the equivalent, transformed cross section of a composite section subjected to uniform compression.
* Analyse and design a composite section subjected to ultimate compressive load.
 | * Written tests
* Assignments
 |
| 1. Demonstrate an understanding of the behaviour, and the method of analysis, of reinforced concrete members subjected to bending.
 | * Apply flexure theory to the analysis and design of reinforced concrete beams and one way slabs (single and double reinforced).
* Demonstrate an awareness of design considerations for shear reinforcement in beams and the required spacing of stirrups
 | * Written Tests
* Assignments
 |
| 1. Demonstrate an understanding of the behaviour of reinforced concrete columns under load and the method of analysis for evaluating ultimate capacity
 | * Elaborate on the more common types of columns in use (i.e. tied versus spiral columns) and the use of load- moment interaction diagrams in their analysis and design.
 | * Assignments
* Written Test
 |
| 1. Demonstrate an understanding of how reinforced concrete is being modified to lower its environmental impact
 | * Identify various components of plain concrete that are used from recycled materials.
* List any components of reinforced concrete that is from recycled materials.
* Explain the effectiveness of various types of reinforcing materials used to strengthen concrete.
 | * Written tests
* Examinations
 |

**Suggested Delivery Methods**

* Practical demonstration of tasks by trainer
* Practice by trainees.
* Observations and comments and corrections by trainers
* Instructor led facilitation of theory

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Client/supplier instructions
* Organizational or external personnel
* Relevant professional/quality standards
* Instructional Equipment as follows:
	+ Overhead projector
	+ Projector Screen
	+ Instructor desktop PC
	+ Whiteboard(s)
* Tools and Equipment as follows:
* Compression testing Machine
* Slump Test Apparatus
* Drying Oven
* Concrete Mixer
* Poker Vibrator
* In-situ water permeable test kit
* Concrete cover meter
* Bulk density kit
* Coarse aggregate density test set
* Organic impurities test set
* Riffle boxes (sample splitters)
* Vibrating Table
* Digital point load tester
* Impact testing machine
* Field CBR equipment
* CBR test machine (hand operated)
* Soil hydrometers
* Plate bearing test machine
* Core cutter
* Rammers
* Block making machine (manually operated)
* Concrete poker vibrator
* Gauge rods
* Chapman flask % voids in aggregates
* Coarse aggregate density test set
* Length gauge
* Automatic mechanical soil compactor
* Soil permeable apparatus
* Motorized CBR machine
* Cone penetrometer
* Plastic limit roller

# ASSISTANT/DEPUTY CONCRETE CONSTRUCTION FOREPERSON

**UNIT CODE:** ENG/CU/CON/CR/07/5/A

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**

This unit addresses Core Competencies 14, 15, 16, 17, 18, and 19:

1. Organize construction site efficiently and effectively.
2. Perform work plan and schedule activities.
3. Procure, receive and engage in proper store keeping.
4. Interpret and compute the bill of materials from the bill of quantities.
5. Observe the relevant/applicable statutory obligations in day to day activities.
6. Exercise proper leadership (communication, delegation, supervision).

**DURATION OF UNIT:** 100 hours

**UNIT DESCRIPTION**

This unit is designed to equip an individual with the competencies required for a CONCRETE CONSTRUCTION FOREPERSON to competently demonstrate an understanding of and skills related to the quality of planning, preparation, and oversight of concrete construction projects. Students are introduced to the principles of planning, administering, scheduling and monitoring the costs of a construction project. Topics include types of contractual arrangements, the stages and components of the tendering process, and the typical steps and processes involved in the administration of a construction project from planning to completion. Successful Completion of this unit will provide the skills and competencies required to work as an Assistant/Deputy Foreperson in the Concrete Construction industry/sector.

**SUMMARY OF CORE COMPETENCY LEARNING OUTCOMES FOR CONCRETE CONSTRUCTION ASSISTANT FOREPERSON UNIT**

1. Examine the construction industry
2. Critique management and organizations
3. Execute and plan site organization and layout
4. Read and interpret contracts

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Examine the construction industry. | * Outline the scope of construction works.
* Describe various types of construction
* Explain the role of various stakeholders
 | * Tests
* Assignments
* Quizzes
 |
| 2.Critique management and organizations | * Explain and apply the meaning, principles and functions of management.
* Explain and apply the meaning and principles of organization.
* Illustrate various types of organization structure.
* Use appropriate office procedures.
 | * Assignments
* Class discussions
* Group discussions
 |
| 3.Execute and plan site organization and layout | * Plan site layout
* Implement site layout
* Read and interpret existing services
 | * Assignments
* Tests/quizzes
 |
| 4.Read and interpret contracts | * Explain the role of parties involved in building contracts
* Outline types of contracts
* Differentiate different types of contract documents
* Describe various methods of tendering
* Apply contract laws
 | * Examination
* Group Assignments
 |

**Suggested Delivery Methods**

* Practical demonstration of tasks by trainer.
* Practice by trainees.
* Observations and comments and corrections by trainers.
* Instructor led facilitation of theory.

**Recommended Resources**

* Occupational Health and Safety standards.
* Standard operating and/or other workplace procedures manuals.
* Specific job procedures manuals.
* Client/supplier instructions.
* Organizational or external personnel.
* Machine/equipment manufacturer’s specifications and instructions.
* Quality standards
* Instructional Equipment as follows:
	+ Overhead projector
	+ Projector Screen
	+ Instructor desktop PC
	+ Whiteboard(s)

# CONCRETE CONSTRUCTION FOREPERSON

**UNIT CODE:** ENG/CU/CON/CR/07/5/A

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**

This unit addresses Core Competencies 14, 15, 16, 17, 18, and 19:

1. Organize construction site efficiently and effectively.
2. Perform work plan and schedule activities.
3. Procure, receive and engage in proper store keeping.
4. Interpret and compute the bill of materials from the bill of quantities.
5. Observe the relevant/applicable statutory obligations in day to day activities.
6. Exercise proper leadership (communication, delegation, supervision).

**DURATION OF UNIT:** 100 hours

**UNIT DESCRIPTION**

This unit is designed to equip an individual with the competencies required for a CONCRETE CONSTRUCTION FOREPERSON to competently demonstrate an understanding of and skills related to construction project management. Students learn how a project manager monitors critical aspects of a project through the importance of project management concepts, such as project cost and scheduling. Successful completion of this unit will provide all of the skills and competencies required to work as a Concrete Construction Foreperson.

**SUMMARY OF CORE COMPETENCY LEARNING OUTCOMES FOR CONCRETE CONSTRUCTION FOREPERSON UNIT**

1. Execute Project Management
2. Interpret and apply relevant construction Laws
3. Perform Human Resource Management
4. Prepare and keep proper accounting records and financial accounts

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Execute Project Management
 | * Outline and explain the management concept
* Apply the work study concept in construction
* Perform contract planning and programming
* Carry out material procurement
 | * Written tests
* Assignments
 |
| 1. Interpret and apply relevant construction Laws
 | * Outline and identify basic principles of laws of Kenya
* Outline and state landownership, mortgages and charge
 | * Written quizzes
 |
| 1. Perform Human Resource Management
 | * Explain personnel management concept
* Handle labour relations
 | * Assignments
 |
| 1. Prepare and keep proper accounting records and financial accounts
 | * Explain various accounting concepts
* Understand various books of account
* Compute financial accounts
 | * Examinations
* Assignments
 |

**Suggested Delivery Methods**

* Practical demonstration of tasks by trainer
* Practice by trainees.
* Observations and comments and corrections by trainers
* Instructor led facilitation of theory

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Client/supplier instructions
* Organizational or external personnel
* Machine/equipment manufacturer’s specifications and instructions
* Quality standards
* Instructional Equipment as follows:
	+ Overhead projector
	+ Projector Screen
	+ Instructor desktop PC
	+ Whiteboard(s)