



National Vocational Certificate level-2, in (Construction Materials Sampler)



Competency Standards

National Vocational and Technical Training Commission
(NAVTTTC) Government of Pakistan



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1. Introduction

Materials which are used for construction purposes are known as the engineering materials or building materials or construction materials. A wide range of building materials are available for the construction of rural buildings and structures. The proper selection of materials to be used in a particular building or structure can influence the Safety, original cost, maintenance, ease of cleaning, durability and, of course, appearance. Usually, construction materials are classified into natural construction material (Water, Mud, Stone, Sand, Wood, Leaves, Lime, Fiber and etc.) and artificial construction material (cement, Brick, Tiles, Glass, Metals, Plastic and etc.). It is necessary for the Civil Engineers/Civil Technologist/Lab Engineers/Lab Assistant to have knowledge about materials, properties and their standard testing methods.

Construction Materials Testing have significant role in the life of every human being, though one may not truly sense its importance in our daily routine. Thus, the importance of civil engineering may be determined according to its usefulness in our daily life. Therefore, industry expectations for skilled workforce are also dynamic which can only be managed through setting relevant competency standards in collaboration with the leading industries. Being familiar of this fact, National Vocational & Technical Training Commission (NAVTTTC) developed competency standards for Construction Material Testing Technology under National Vocational Qualifications Framework (NVQF). These competency standards have been developed by a Qualifications Development Committee (QDC) and validated by the Qualifications Validation Committee (QVC) having representation from the leading Construction, Real States & Builder industry of the country.

2. Purpose of the Qualification

The purpose of this qualification is to set high professional standards for construction Materials Testing technology sector. The specific objectives of developing these qualifications are as under:

- Improve the professional competence of the trainees
- Provide opportunities for recognition of skills attained through non-formal or informal pathways
- Improve the quality and effectiveness of training and assessment for construction Materials Testing industry
- Enable the existing workforce to capacitate themselves in new technologies and methods



3. Core competencies of the Qualification

The Construction Materials Sampler of level-2 consists 20% Theory and 80% Practical. The Core competencies of the qualification are as follows:

1. Construction Materials Sampler Level-2

11.1 Sampling of Materials

No.	Name of Occupations and Competency Standards	Level	Contact Hour		
			Th	Pr	Total
11.01.1	Maintain the Sampling field Testing Tools	2	5	21	26
11.01.2	Perform sampling of construction materials.	2	12	48	60
11.01.3	Perform sampling of construction process & products.	2	11	54	65
11.01.4	Perform water sampling	2	8	36	44
11.01.5	Perform Site Investigation Activities	2	11	48	59
11.01.6	Observe Safety at construction site	2	17	78	95
Total			64	285	349

11.2 Basic Drawing

No.	Name of Occupations and Competency Standards	Level	Contact Hour		
			Th	Pr	Total
11.02.1	Construct Scales for Drawing	2	2	12	14
11.02.2	Construct Geometrical Figures	2	4	21	25
11.02.3	Produce Orthographic Projections	2	3	21	24
11.02.4	Perform Dimensioning on Drawings	2	2	6	8
11.02.5	Develop Symbols of Engineering Drawings	2	3	18	21
11.02.6	Interpret construction plans/ coordinate	2	4	12	16
Total			18	90	108

11.03 Workshop Practices

No.	Name of Occupations and Competency Standards	Level	Contact Hour		
			Th	Pr	Total
11.03.1	Apply Wooden hand tools	2	2	9	11
11.03.2	Perform wooden joinery work	2	2	21	23
11.03.3	Apply wooden fastenings	2	3	9	12
11.03.4	Perform cutting, threading & reaming of pipes	2	3	9	12
11.03.5	Join pipes & fittings	2	4	21	25
11.03.6	Install plumbing fixtures	2	3	18	21
11.03.7	Construct Sewers	2	4	9	13
11.03.8	Perform Basic Electric Installations	2	12	24	36
Total			33	120	153
Grand Total of Level 2			115	495	610



4. Date of Validation

The level-2 of National qualification on construction Materials Sampler has been validated by the Qualifications Development Committee (QDC) members on **04-08-2020 to 08-08-2020** and will remain valid for 10 years

5. Codes of Qualifications

The International Standard Classification of Education (ISCED) is a framework for assembling, compiling and analyzing cross-nationally comparable statistics on education and training. ISCED codes for these qualifications are assigned as follows:

ISCED Classification for Construction Materials Testing level-5	
Code	Description
	Level 2 National Qualification Certificate, in “Construction Materials Sampler”
	Level 3 National Qualification Certificate, in “Construction Materials Assistant”
	Level 4 National Qualification Certificate, in “Construction Materials Technician”
	Level 5 National Qualification Diploma, in “Construction Materials Supervisor”

6. Members of Qualifications Development Committee

The following members participated in the qualification's development and validation of these qualifications:

S#	Name	Designation	Organization
1	Engr. Azhar Iqbal Shad	Principal	GCT Raiwnd Road, LHR
2	Mr. Nadeem Zaigham	Senior Instructor	GCT Raiwnd Road, LHR
3	Mr. Imtiaz Ahmad Awan	Sr. Instructor Civil	GCT Rasul (M.B.Din)
4	Muhammad Amjad Rafique	Sr. Instructor Civil	GCT Rasul (M.B.Din)
5	Mr. Liaquat Ali Sajid	Sr. Instructor Civil	GCT Rasul (M.B.Din)
6	Engr. Arslan Hameed	Research, Associate Officer	Planning & Project Deptt. Lahore
7	Engr. Ayub Nasir	Site Material Testing Engr.	Ex. FWO Islamabad
8	Engr. Inayat ur Rehman	DACUM, Facilitator	Peshawar
9	Muhammad Ishaq	QDC Coordinator	NAVTTTC, Islamabad



7. Members of Qualifications Validation Committee

The following members participated in the qualification's development and validation of these qualifications:

S#	Name	Designation	Organization
1	Engr. Azhar Iqbal Shad	Principal	GCT Raiwind Road, LHR
2	Mr. Nadeem Zaigham	Senior Instructor Civil	GCT Raiwind Road, LHR
3	Mr. Imtiaz Ahmad Awan	Senior Instructor Civil	GCT Rasul (M.B.Din)
4	Mr. Muhammad Amjad Rafique	Senior Instructor Civil	GCT Rasul (M.B.Din)
5	Engr. Abdul Rasheed	Associate Professor Civil	GCT Peshawar KPTEVTA
6	Engr. Norheen Amina	Consultant	Allied Engg Services/ Lahore
7	Engr. Rebab Maria Mahmood	Site Engineer	IMC Lahore/ Industry
8	Engr. Habiba Mohsin	Project Manager	Jers Engg Lahore/ Industry
9	Mr. Muhammad Dawood Bashir	STI	GCT Mirpur AJK TEVTA
10	Mrs. Syeda Fatima Iqbal	Representative	PBTE Lahore
11	Mr. Liaqat Ali Jhamroo	Representative	STEVTA
12	Engr. Inayat ur Rehman	DACUM, Facilitator	Peshawar
13	Mr. Muhammad Ishaq	QDC Coordinator	NAVTTTC, Islamabad

8. Entry Requirements

The entry for National Certificate level 2, in Construction Materials Sampler are

1. A person having Matric certificate with Science subjects for entry level-2

9. Scheme of Studies

1. Construction Materials Sampler Level-2

S#	Occupation/ Subjects	Category	Total Contact Hours			Credit	Periods Per Week			No. of Weeks
			Th	Pr.	Total		Th	Pr	Total	
11.1	Sampling of Materials	Technical	64	285	349	34.9	4	18	22	16
11.2	Basic Drawing	Technical	18	90	108	10.8	1	6	7	16
11.3	Workshop Practices	Technical	33	120	153	15.3	2	7	9	16
		Allied								
		Allied								
	Total		115	495	610	61	7	31	38	



10. A- Occupation Packaging of Construction Materials Testing

S.#	Name of Occupation	Level	Generic Skills	Core Skills
1.	Building Materials Sampler	2	11.2.1,11.2.4, 11.2.5	11.1.01, 11.1.02, 11.1.03, 11.1.05, 11.2.6
2.	Highway Materials Testing Sampler	2	11.2.1,11.2.4, 11.2.5	11.1.01, 11.1.03, 11.1.04, 11.1.05, 11.1.06, 11.2.6
3.	Building Materials Assistant	3	11.6.4, 11.6.5, 11.4.5	11.4.1 to 11.4.4, 11.6.1, 11.7.1, 11.7.2
4.	Highway Materials Testing Assistant	3	11.6.4, 11.6.5, 11.4.5	11.4.1 to 11.4.2, 11.2.4, 11.6.1, 11.9.1 to 11.9.5
5.	Building Materials Technician	4	11.12.5, 11.12.7, 11.24.3	11.10.1 to 11.10.6, 11.14.1 to 11.14.10, 11.15.1 to 11.15.4, 11.16.1 to 11.16.3, 11.21.3, 11.23.1 to 11.23.6.
6.	Highway Quality Control Inspector	4	11.12.5, 11.12.7, 11.24.3	11.9.1 to 11.9.9, 11.13.1 to 11.13.7, 11.16.1 to 11.16.3, 11.19.2, 11.21.3
7.	Bridge Inspector (NDT)	4	11.12.5, 11.12.7, 11.24.3	11.22.1 to 11.22.11, 11.23.1 to 11.23.12
8.	Public Health Quality Control Inspector	4	11.12.5, 11.12.7	11.11.1 to 11.11.5, 11.22.8 to 11.22.10
9.	Construction Plants Operator	4	11.12.5, 11.12.7, 11.24.3	11.13.8, 11.17.1 to 11.17.3
10	Field Testing Lab Assistant	3	11.6.1, 11.6.3, 11.6.4, 11.6.5	11.4.1, 11.1.1, 11.1.3, 11.1.4, 11.1.5, 11.1.6, 11.3.8, 11.9.1 11.9.4, 11.10.1, 11.10.3, 11.14.1 to 11.17.3
11.	Field Testing Lab Technician	4	11.2.6, 11.2.8. 11.2.9, 11.2.10, 11.2.11,11.2.15,	11.4.1, 11.1.2, 11.1.3, 11.1.4, 11.1.5, 11.1.6, 11.4.3, 11.4.4, 11.3.8, 11.9.1, 11.9.3, 11.9.4, 11.9.8, 11.10.1 to 11.10.3, 11.10.5, 11.14.1, 11.14.3



10. B-Qualification Packaging of Construction Materials Testing

S.#	Name of Qualification	Level	Generic Skills	Core Skills
1	Construction Materials Sampler	2	11.2.1 to 11.2.5	11.1.1 to 11.1.6, 11.2.6, 11.3.1 to 11.3.8
2	Construction Materials Assistant	3	11.4.5, 11.6.1 to 11.6.6	11.4.1 to 11.4.5, 11.5.1 to 11.5.4, 11.7.1 to 11.4.3
3	Construction Materials Technician	4	11.12.1 to 11.12.8	11.8.1 to 11.8.7, 11.9.1 to 11.9.9, 11.10.1 to 11.10.6, 11.11.1 to 11.11.5, 11.13.1 to 11.13.8, 11.14.1 to 11.14.10, 11.15.1 to 11.15.4
4	Construction Materials Supervisor	5	11.24.1 to 11.24.9	11.16.1 to 11.16.3, 11.17.1 to 11.17.3, 11.18.1 to 11.18.3, 11.19.1 to 11.19.5, 11.20.1 to 11.20.2, 11.21.1 to 11.21.4, 11.22.1 to 11.22.11, 11.23.1 to 11.23.12



11. Detail of Qualifications and its Competency Standards

A. National Qualification Certificate Level 2 in Construction Materials Sampler

11.1. Sampling of Materials

11.1.1. Maintain the sampling and field-testing tools

Overview: This competency standard covers the skills and knowledge required to create the basic skills of up keeping, selection of tools for performing the sampling of construction materials and products and routine maintenance of tools.

Competency Units	Performance Criteria
CU1. Select tools for specific sampling job.	P1. Identify the sampling and field-testing tools. P2. Select the tools and apparatus required for sampling of water and for allied field tests. P3. Select the set of tools and instruments required for aggregate sampling. P4. Select the tools and apparatus required for cement and concrete sampling and field testing. P5. Select the set of tools and apparatus required for collection of soil sample and its field testing. P6. Select the set of tools and equipment required for collection of samples of bitumen and its products. P7. Collect the tools from the store for specific job. P8. Clean and lubricate the tools. P9. Place tools at appropriate place.
CU2. Maintain the tools and equipment.	P1. Check Physical Condition of Tools and Equipment before use P2. Perform measurements with the measuring tools such as; measuring tape, measuring jar, metal gauge, vernier caliper, micrometer, weighing balance, pressure gauges and thermometer etc. P3. Perform routine maintenance as per standards. P4. Clean the tools and equipment after use P5. Place tools and equipment at appropriate place after use.



CU3. Follow the standard housekeeping procedures in lab and field	P1. Arrange the testing tools and equipment at appropriate positions in store. P2. Protect instrument and equipment from heat, dust and moisture. P3. Carry and store loose and fluid materials like chemical admixtures as per standard safety practices. P4. Identify and label the damaged and out of order tools and equipment. P5. Maintain the inventory record of tools, instruments and equipment. P6. Prepare the maintenance log sheet of tools and equipment.
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Knowledge & Understanding.

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K-1.** Define the Sampling
- K-2.** Explain the use of the tools and equipment required for the sampling of Water, Aggregates, Cement, Concrete, Soil and bitumen.
- K-3.** Explain the importance of Stores, inventory Management and the procedure to store the tools and apparatus in safe condition.
- K-4.** State Basic measuring units and its inter-conversion.
- K-5.** Explain the Types of Measuring tools and its Use
- K-6.** State Preventive and corrective measures for tools and equipment against vulnerability.
- K-7.** Explain the importance of safe storage of tools and equipment and easy to identify at place.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- List of the required tools to use for sampling of concrete, soil, water and aggregates.
- Cleaning and Lubrication the tools and apparatus as per Standard
- Routine Checking to ascertain the Physical Condition of Tools & Equipment before use.
- Assembling the Tools and Equipment.
- Maintenance of tools and equipment as per standards.
- Housekeeping of the laboratory.



TOOLS AND EQUIPMENT'S

- Weighing balance
- Sample container,
- Thermometer,
- Humidity meter
- Sieve set,
- Core cutter apparatus
- Platform scale
- Slump Test Apparatus
- Wheel Barrow
- Bucket
- Straight Edge
- Shovels with handle
- Mortar Pan
- Metallic Tape
- sampling containers, filters and sieves
- multi-probes meters (e.g. dissolved oxygen, electrical conductivity, pH, turbidity, nitrates, phosphates and temperature)
- portable colorimeters
- Beaker
- Burette
- Pipette
- Erlenmeyer flasks
- Indicator solutions
- First aid kit.
- Sieve shaker
- Lubrication oil



11.1.2. Perform sampling of construction materials.

Overview: This competency standard covers the skills and knowledge required to collect, prepare and preserve test samples of construction materials i.e. aggregates, cement, bricks, marble & soil etc and performing simple field tests required for preparation of specific material samples.

Competency Units	Performance Criteria
CU1. Carry out initial preparatory activities.	P1. Confirm the sampling location, number and type of samples, and timing and frequency of sampling from the sampling plan. P2. Identify site and sampling hazards associated with the sample preparation, test methods, reagents and equipment. P3. Select and arrange the sampling equipment, sample container and accessories. P4. Prepare all solutions / reagents ready for field use. P5. Perform pre-use and safety checks in accordance with relevant instrumental procedures. P6. Identify faulty or unsafe components and equipment and report to appropriate personnel P7. Check calibration status of instruments and report any out-of-calibration items to appropriate personnel. P8. Plan work sequences for optimum efficiency and safety for collection of multiple samples.
CU2. Collect aggregates samples.	P1. Locate sampling site. P2. Assemble and check operations of all sampling and field-testing equipment & accessories. P3. Clean/decontaminate the sample container and sampling tools P4. Select and collect the required quantity of aggregates samples from the piles/stacks as per sampling plan and standard sampling procedures. P5. Take photos/snaps of sampling sites and samples. P6. Perform sample preparations, such as washing, weighing, and sieving the required quantity of material as per standard sampling procedure P7. Record the results of tests in the sampling document P8. Record sample appearance, environmental conditions and any



	other factors that may impact on sample integrity.
CU3. Extract soil samples, pack, label and store as per standard procedures	P1. Locate sampling site. P2. Assemble and check operations of all sampling and field-testing equipment and accessories. P3. Clean/decontaminate the sample container and sampling tools P4. Perform soil sample extraction, using core cutter or other methods, as per standard procedure P5. Take photos/snaps of sampling sites and samples. P6. Carry out weighing, measuring and determine bulk density and moisture content of samples as per specified procedures. P7. Record the results of tests in the sampling document P8. Record sample appearance, environmental conditions and any other factors that may impact on sample integrity.
CU4. Collect the bricks,tiles and marble/stone samples.	P1. Locate sampling site. P2. Assemble and check operations of all sampling equipment and accessories i.e. sample container, weighing balance, etc. P3. Clean/decontaminate the sample container and sampling tools P4. Select and collect the required quantity of bricks/tiles/marble/stone samples from the stacks as per sampling plan and standard sampling procedures. P5. Take photos/snaps of sampling sites and samples. P6. Perform test as per standard procedure for determining the physical properties of bricks/tiles/marble/stone. P7. Carry out weighing and packing of sample a as per standard sampling procedure P8. Record the results of tests in the sampling document P9. Record sample appearance, environmental conditions and any other factors that may impact on sample integrity
CU5. Prepare the cement test samples .	P1. Locate sampling site. P2. Assemble and check operations of all sampling equipment and accessories i.e. sample container, weighing balance, thermometer and humidity meter etc. P3. Clean/decontaminate the sample container and sampling tools P4. Select and collect the required quantity of cement samples from the stacks as per sampling plan and standard sampling



	procedures. P5. Take photos/snaps of sampling sites and samples. P6. Carry out weighing and packing of sample and note the ambient temperature and humidity etc as per standard sampling procedure. P7. Record the results of tests in the sampling document P8. Record sample appearance, environmental conditions and any other factors that may impact on sample integrity.
CU6. Preserve and document the sampling.	P1. Take photos/snaps of sampling sites and samples. P2. Prepare sub-samples and back-up sub-samples that are representative of the source. P3. Pack and seal the sample and sub-samples in the presence of witnesses according to sampling rule and procedure P4. Label samples in accordance with traceability requirements. P5. Complete the sampling document; fill in the sample date, time, weight/volume, sample ID, preservative used, sample location and sampler name etc.
CU7. Handle, store and transport the samples.	P1. Store the sub-samples in accordance with the sampling procedure and rules for maintaining the sample integrity and traceability. P2. Deliver samples to reception point in accordance with standard operating procedures. P3. Record details of sample exchange in relevant sections of chain of custody forms. P4. Report any hazard to supervisor.
CU8. Maintain a safe work environment	P1. Use defined safe work practices and personal protective equipment to ensure personal safety and that of others. P2. Clean all equipment, containers and work area according to workplace procedures P3. Rehabilitate sampling site to render it safe and minimize environmental impacts. P4. Collect and/or dispose of all waste in accordance with environmental requirements and workplace procedures P5. Clean and care all equipment and check serviceability of equipment before storage.



Knowledge & Understanding.

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K-1.** Explain pre-requisite measures prior to proceed for Sampling in field.
- K-2.** Define hazards, prepare a list of hazards associated with sample preparation.
- K-3.** Define the Calibration and its importance.
- K-4.** Explain the procedure of Calibration of relevant tools and equipment.
- K-5.** Define Fine aggregates and Coarse aggregates. Explain Physical, Chemical and Mechanical Properties of aggregates.
- K-6.** Define ASTM D75 / D75M.
- K-7.** Explain Methods of collecting test samples of Aggregates based upon the type of test and aggregates.
- K-8.** Define Soil, Adhesive Soil, Sandy Soil, Loam and Clay.
- K-9.** Define ASTM D4700.
- K-10.** Explain Methods of collecting test samples of Soil based upon the type of test and Soil.
- K-11.** Define Brick, Tile, Marble and Stone.
- K-12.** Define ASTM C67 / C67M.
- K-13.** Explain Methods of collecting test samples of Bricks, tiles and marble based upon the type of test and stated material.
- K-14.** Define Binding Materials. Define Cement. Enlist the Types of Cement by its chemical properties.
- K-15.** Define ASTM C183/C183M.
- K-16.** Explain Methods of collecting test samples of Cement based upon the type of test and Cement.
- K-17.** Explain the Importance of Sample preservation.
- K-18.** Explain Sample preservation method, such as ph. control, chemical addition, refrigeration and freezing etc.
- K-19.** Explain the standard practice of tagging/numbering/labelling the collected samples.
- K-20.** Explain the Standard procedures of packing of test samples for transportation.
- K-21.** Explain the Standard practice for storing and stacking the test samples of various materials as per standards.
- K-22.** Explain the importance of safe work practice for self, persons and environment protection.
- K-23.** Enlist the steps to protect the tools and apparatus against the damages.
- K-24.** Explain the standards to dispose of the waste.
- K-25.** Define ISO 14001 and ISO 45001 Codes



Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Flow diagram exhibiting the Plan work sequence to Collect the Samples in accordance with relevant code and Standard procedure.
- Sampling documents such as fill in the sample date and time and weight/measure, temperature, pH value, sampler name, sample tag/ ID#, preservative used, sample location and sampling equipment etc
- Sampling of aggregates in accordance with the relevant code and Standard procedure.
- Sampling of Soil in accordance with the Purpose, relevant codes and Standard procedure.
- Sampling of Bricks, Tiles and marble/Stone in accordance with the Purpose, relevant code and Standard procedure.
- Sampling the Cement in accordance with the Purpose, relevant code and Standard procedure.
- labelling the samples and sub-samples to satisfy traceability requirements of the enterprise / accreditation
- Flow diagram to Select and check all required field equipment, instruments and materials and safely transporting them to and from site.
- List of equipment to be used while performing the samples of materials for self and for the safety of tools

TOOLS AND EQUIPMENT'S

Measuring Tape	Standard cement cube molds
Metallic Tri-Square	Gauging trowel
Spirit level	Standard sieves for Fine aggregate tests
Steel scale	Standard sieves for coarse aggregate test
Weighing balance	Pycnometer
Weighing dishes	calibrated volume measure for density test,
Enameled trays	tamping rod
Desiccators	Brushes
Thermometers,	Funnels
Vernier calipers	Graduated glass measuring cylinders
Stopwatch	Slump cone Apparatus
Straight edge	compacting factor test apparatus
Trowels	Flow table test apparatus



Vicat apparatus	Vee Bee test apparatus
Le-Chatelier apparatus	Compression testing machine
Le-Chatelier flask	Casagrande apparatus
Plastic limit test apparatus	Shrinkage test apparatus
Cylindrical metal container	heating oven
elongation gauge	flakiness gauge
Impact value apparatus	Marshall stability test apparatus
Speedy moisture meter apparatus	Skid Resistance /Abrasion value apparatus
Specific gravity bottle	mechanical sieve shaker
flash and fire point test apparatus	bitumen compactor
Safety Helmets	Safety Shoes (Assorted size)
Safety goggles	Ear Plug
Shovels	Face Mask
Lab coat	



11.1.3. Perform sampling of construction process & products.

Overview: This competency standard covers the skills and knowledge required to collect, prepare and preserve test samples of cement concrete and asphalt concrete and performing simple field tests required for preparation of specific material samples.

Competency Units	Performance Criteria
CU1. Carry out initial preparatory activities.	P1. Confirm the sampling location, number and type of samples, and timing and frequency of sampling from the sampling plan. P2. Identify site and sampling hazards associated with the sample preparation, test methods, reagents and equipment. P3. Select and arrange the sampling and field-testing equipment, and accessories. P4. Perform pre-use and safety checks in accordance with relevant instrumental procedures. P5. Identify faulty or unsafe components and equipment and report to appropriate personnel P6. Check calibration status of instruments and report any out-of-calibration items to appropriate personnel. P7. Plan work sequences for optimum efficiency and safety for collection of multiple samples.
CU2. Prepare concrete samples,(cast cube/cylinder) at site as per standard procedures and sampling rules.	P1. Identify locations for sample collection in accordance with sampling plan and test method. P2. Set up, check and operate test equipment safely and in accordance with workplace procedures and test method P3. Collect samples of fresh concrete from a desired batch as per sampling plan sampling rules. P4. Perform slump test as per standard procedures P5. Take sufficient test measurements to ensure reliable data P6. Record the results of slump tests in the sampling document P7. Cast concrete cubes/cylinders in required quantity as per standard procedure. P8. Label the concrete cubes/cylinders and engrave identification mark on it. P9. Store concrete cubes/cylinders in humidity chamber as per



	standard procedure. P10. Recognize and record sample appearance, environmental conditions and any other factors that may impact on sample integrity. P11. Re-instate all disturbed surfaces in accordance with workplace procedures
CU3. Extract asphalt concrete test samples at site as per standard procedures and sampling rules	P1. Identify locations for sample collection in accordance with sampling plan and test method. P2. Set up, check and operate test equipment safely and in accordance with workplace procedures and test method P3. Collect the required numbers of asphalt concrete layer cores by core cutter from the selected locations as per sampling plan. P4. Carry out weighing and determine bulk density of sample and note the ambient temperature and humidity etc as per standard sampling procedure P5. Record the results of tests in the sampling document P6. Record sample appearance, environmental conditions and any other factors that may impact on sample integrity P7. Re-instate all disturbed surfaces in accordance with workplace procedures
CU4. Extract concrete test samples at site as per standard procedures and sampling rules	P1. Identify locations for sample collection in accordance with sampling plan and test method. P2. Assemble and check operations of all sampling equipment and accessories i.e. sample container, weighing balance, thermometer and humidity meter etc. P3. Collect the required numbers of cement concrete slab cores by core cutter from the selected locations as per sampling plan. P4. Carry out weighing and packing of sample and note the ambient temperature and humidity etc as per standard sampling procedure. P5. Perform field test by Rebound hammer for ascertaining the strength of concrete structure. P6. Take sufficient test measurement of Rebound hammer to ensure reliable data. P7. Record the results of tests in the sampling document



	P8. Recognize and record any information about site conditions that may impact on sample integrity.
CU5. Preserve and document the sampling.	P1. Take photos/snaps of sampling sites and samples. P2. Prepare sub-samples and back-up sub-samples that are representative of the source. P3. Pack and seal the sample and sub-samples in the presence of witnesses according to sampling rule and procedure P4. Label samples in accordance with traceability requirements. P5. Complete the sampling document; fill in the sample date, time, weight/volume, sample ID, preservative used, sample location and sampler name etc.
CU6. Handle, store and transport the samples.	P1. Organize their safe curing, storage and transport of samples/sub-samples in accordance with sampling procedure and rules. P2. Deliver samples to reception point in accordance with standard operating procedures. P3. Record details of sample exchange in relevant sections of chain of custody forms. P4. Complete site safety plans, equipment logs and test reports in accordance with workplace procedures
CU7. Maintain a safe work environment	P1. Use defined safe work practices and personal protective equipment to ensure personal safety and that of others. P2. Clean all equipment, containers and work area according to workplace procedures P3. Rehabilitate sampling site to render it safe and minimize environmental impacts. P4. Collect dispose off all waste in accordance with environmental requirements and workplace procedures P5. Clean and care all equipment and check serviceability of equipment before storage.

Knowledge & Understanding.

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of.

K-1. Explain pre-requisite measures prior to proceed for Sampling of Concrete in field.



- K-2.** Define hazards, prepare a list of hazards associated with Concrete sample preparation.
- K-3.** Define Cement Concrete
- K-4.** State the ingredients of Cement Concrete
- K-5.** State Physical, chemical & mechanical properties of Cement Concrete
- K-6.** State different factors affecting the workability of Cement concrete.
- K-7.** Explain different methods of mix design, transportation of fresh Cement concrete it's placing and compaction.
- K-8.** Define Cubic and Cylindrical strength of Cement Concrete
- K-9.** Define BS EN 12350-1:2000 and BS 1881-108:1983
- K-10.** State the different recommended values of slumps for various conditions of placements
- K-11.** Explain Methods of collecting test samples of Cement Concrete based upon the type and standards.
- K-12.** Define Asphalt and Asphalt Concrete
- K-13.** State the ingredients of asphalt Concrete
- K-14.** State Physical, chemical & mechanical properties of Asphalt Concrete.
- K-15.** Define ASTM D979 / D979M Standard.
- K-16.** Explain Methods of collecting test samples of Asphalt Concrete based upon the type of test
- K-17.** Explain Methods of collecting test samples of Concrete based upon the type of test at Site.
- K-18.** Explain the Importance of Concrete Sample preservation.
- K-19.** Explain Concrete Sample preservation method, such as ph. control, chemical addition, refrigeration and freezing etc.
- K-20.** Explain the standard practice of tagging/numbering/labelling the collected samples of Concrete
- K-21.** Explain the Standard procedures of packing of test samples of Concrete for transportation.
- K-22.** Explain the Standard practice for storing and stacking the test samples of Concrete as per standards.
- K-23.** Explain the importance of safe work practice for self, persons and environment protection while performing Concrete works.



K-24. Enlist the steps to protect the tools and apparatus for Concrete sampling against the damages.

K-25. Explain the standards to dispose of the waste of Concrete

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Flow diagram exhibiting the Plan work sequence to Collect the Samples of Concrete in accordance with relevant code and Standard procedure.
- Sampling documents for Concrete such as fill in the sample date and time and weight/measure, temperature, pH value, sampler name, sample tag/ ID#, preservative used, sample location and sampling equipment etc
- Sampling the Cement Concrete in accordance with the Purpose, relevant code and Standard procedure.
- Sampling the Asphalt Concrete in accordance with the Purpose, relevant code and Standard procedure.
- Sampling the Concrete in accordance with the Purpose, relevant code and Standard procedure at Site
- labelling the Concrete samples and sub-samples to satisfy traceability requirements of the enterprise / accreditation.
- Flow diagram to Select and check all required field equipment, instruments and materials and safely transporting them to and from site for Concrete.
- List of equipment to be used while performing the samples of Concrete for self and for the safety of tools

TOOLS AND EQUIPMENT'S

Weighing balance	Sample container,
Thermometer,	Humidity meter
Sieves set,	Core cutter apparatus
Platform scale	Slump Test Apparatus
Compacting Factor Apparatus	Wheel Barrow
Bucket	Straight Edge
Shovels with handle	Mortar Pan
Straight Edge	Metallic Tape
Speedy Moisture Meter	Mortar pans



11.1.4. Perform water sampling

Overview: This competency standard covers the skills and knowledge required to collect, prepare and preserve samples of natural, polluted and process water for both chemical and microbiological parameters and perform field tests on them as required for the purpose.

Competency Units	Performance Criteria
CU-1. Carry out initial preparatory activities	P1. Confirm the sampling location, number and type of samples, and timing and frequency of sampling from the sampling plan. P2. Identify site and sampling hazards and review workplace safety procedures. P3. Select and check the sampling and field-testing equipment, sample container and accessories. P4. Prepare all solutions / reagents ready for field use. P5. Plan work sequences for optimum efficiency and safety for collection of multiple samples.
CU-2. Conduct sampling of water.	P1. Locate sampling site. P2. Assemble and check operations of all sampling equipment and accessories. P3. Clean/decontaminate the sample container and sampling tools P4. Collect samples according to sampling plan and standard sampling procedures P5. Take photos/snaps of sampling sites and samples. P6. Record all information and label samples in accordance with traceability requirements. P7. Record sample appearance, environmental conditions and any other factors that may impact on sample integrity.
CU-3. Perform field tests and preserve the sample.	P1. Take the temperature of sample and ambient temperature. P2. Prepare apparatus (Multi-probe meter) for determining; pH, Turbidity, Dissolved oxygen and Electrical conductivity as per Standard operating procedure. P3. Perform test as per standard procedure for determining the physical properties of water and wastewater. P4. Record the results of tests in the sampling document. P5. Preserve the samples by adopting appropriate preservation method keeping in view the purpose of sampling.



	P6. Prepare sub-samples and back-up sub-samples that are representative of the source. P7. Pack and seal the sample and sub-samples in the presence of witnesses according to sampling rule and procedure P8. Complete the sampling document; fill in the sample date, time, weight/volume, sample ID, preservative used, sample location and sampler name etc.
CU-4. Handle, store and transport the samples.	P1. Store the sub-samples in accordance with the sampling procedure and rules for maintaining the sample integrity and traceability. P2. Place samples at the required controlled temperature environment in the specified container. P3. Deliver samples to reception point in accordance with standard operating procedures. P4. Record details of sample exchange in relevant sections of chain of custody forms. P5. Report any misadventures to supervisor.
CU-5. Maintain a safe work environment	P-1 Use PPEs and apply safe work practices. P-2 Rehabilitate sampling site and minimize generation of wastes. P-3 Collect and/or dispose of all waste in accordance with environmental requirements and workplace procedures P-4 Clean and care all equipment and check serviceability of equipment before storage.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- K-1.** Explain portable water
- K-2.** Explain pre-requisite measures prior to proceed for Sampling of Water in field.
- K-3.** Define hazards, prepare a list of hazards associated with Water sample preparation.
- K-4.** Explain contaminated water and its adverse consequences to construction works.
- K-5.** Explain Scientific terminology regarding water chemistry.
- K-6.** Explain Physical and chemical properties of water and contaminations.
- K-7.** Define ASTM D3370 - 18 Standard Practices for Sampling Water



- K-8.** Define ISO 5667-15:2009 (en), Water quality Sampling
- K-9.** Explain Methods of collecting test samples of Water based upon the type and standards
- K-10.** Explain pH value of water
- K-11.** Explain Methods of collecting test samples of Water based upon the type of test in field.
- K-12.** Explain the Standard procedures of packing of test samples of Water for transportation.
- K-13.** Explain the Standard practice for storing and stacking the test samples of Water as per standards.
- K-14.** Explain the importance of safe work practice for self, persons and environment protection while performing Water Sampling.
- K-15.** Enlist the steps to protect the tools and apparatus for Water sampling against the damages.
- K-16.** Explain the standards to dispose of the waste of Water

Critical Evidence(s)

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Flow diagram exhibiting the Plan work sequence to Collect the Samples of Water in accordance with relevant code and Standard procedure.
- Sampling documents for Water such as fill in the sample date and time and weight/measure, temperature, pH value, sampler name, sample tag/ ID#, preservative used, sample location and sampling equipment etc.
- Sampling the Water in accordance with the Purpose, relevant code and Standard procedure.
- Sampling the Water in accordance with the Purpose, relevant code and Standard procedure in field.
- Flow diagram to Select and check all required field equipment, instruments and materials and safely transporting them to and from site for Water.
- List of equipment to be used while performing the samples of Concrete for self and for the safety of tools

TOOLS AND EQUIPMENT'S

- sampling containers, filters and sieves
- parameter specific meter or multi-probes (e.g. dissolved oxygen, electrical conductivity, pH, turbidity, nitrates, phosphates and temperature)
- portable colorimeters
- Beaker



- Burette
- Pipette
- Erlenmeyer flasks
- Indicator solutions
- First aid kit.



11.1.5. Perform Site Investigation Activities

Overview: This competency standard covers the skills and knowledge required to Prepare for on-site operations, conduct excavation of boreholes, test pits and/or trenches, Conduct Site sampling, Conduct site testing, Complete site operations, Maintain Records, Maintain safe work environment

Competency Units	Performance Criteria
CU1. Prepare for on-site operations	P1. Confirm details of the job, location, work instructions, appropriate sampling/test procedures and safety requirements with supervisor P2. Identify likely site hazards, personal protective equipment (PPE) and safety procedures that are specified for the job and materials used P3. Collect, check and stow all tools, equipment and materials required at the site P4. Confirm site access requirements, such as entry permits and participate in safety induction as required
CU2. Conduct excavation of boreholes, test pits and trenches	P1. Confirm specified sampling/testing locations with supervisor P2. Excavate to the specified sampling/testing depth, minimising disturbance and potential contamination of the site P3. Ensure materials from different strata are kept separate P4. Identify materials and record changes of the strata and the test results
CU3. Conduct Site sampling.	P1. Prepare and check sampling equipment and materials P2. Take disturbed and undisturbed samples as directed and in accordance with workplace methods and procedures P3. Label samples and record samples/site conditions in accordance with workplace methods and procedures
CU4. Conduct site testing	P1. Conduct pre-use checks of test equipment P2. Perform basic tests as directed and in accordance with test methods or workplace procedures P3. Record data in accordance with test methods or workplace procedures P4. Recognise obvious errors or atypical data and seek advice
CU5. Complete site operations	P1. Reinstate the site in accordance with instructions P2. Clean all equipment (and vehicle as necessary) avoiding



	environmental damage, stormwater contamination or spread of pests P3. Check all equipment and materials prior to re-stowing them for safe transport P4. Handle and transport samples in accordance with workplace procedures P5. Notify appropriate site personnel on completion of tasks and prior to leaving site (if unsupervised) P6. Check serviceability of test equipment before storage
CU6. Maintain Records	P1. Record details of site sampling, testing and material types in accordance with workplace procedures P2. Maintain confidentiality of workplace information in accordance with workplace procedures
CU7. Maintain safe work environment	P1. Use safe work procedures and PPE to ensure personal safety and that of others P2. Minimise environmental impacts of testing/sampling and generation of waste P3. Collect and dispose of all waste in accordance with workplace procedures

Knowledge & Understanding.

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1** Explain pre-requisite measures prior to proceed for Site investigation Activities.
- K2** Define hazards, prepare a list of hazards associated with Site investigation sample preparation.
- K3** Define BS 5930:2015 Code of practice for ground investigations
- K4** Explain the necessity of bore holes to conduct site/ground investigation. Explain the purpose of Site investigation.
- K5** Explain about the equipment to collect Soil investigation sample.
- K6** Explain Methods of collecting test samples to investigate the site/Ground based upon the type of test in field
- K7** Explain test Procedure related to Soil Investigation at site in accordance with standard codes and Practice.
- K8** State site measurements, including location and depth



- K9** State the importance of reinstatement the site after the completion of operation.
- K10** Explain the importance of safe work practice for self, persons and environment protection while performing Site investigation activities
- K11** Enlist the steps to protect the tools and apparatus for Soil investigation, against the damages.
- K12** Explain the standards to dispose of the waste because of soil investigation activities.
- K13** Define data. Explain the importance to record the Data. Explain the copy right and confidentiality of data.
- K14** Explain the use of site investigation data.
- K15** Explain the importance of safe work practice for self, persons and environment protection while performing Site investigation Activities.
- K16** Enlist the steps to protect the tools and apparatus use for Site Investigation activities, against the damages.
- K17** Explain the standards to dispose of the waste during site investigation activities.
- K18** Describe Numeracy skills to: interpret maps, site plans and drawings, recognize site features and soil, rock and fill materials.
- K19** State the procedure to perform basic in situ tests and site measurements, including location and depth.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Flow diagram exhibiting the Plan work sequence to Collect the Samples to investigate the Site/Ground in accordance with relevant code and Standard procedure.
- Sampling documents for Site investigation activities such as fill in the sample date and time and weight/measure, temperature, pH value, sampler name, sample tag/ ID#, preservative used, sample location and sampling equipment etc
- Bore hole at site or visit any industrial site individually or conduct group activity and write the Conceived practical knowledge. (assignment)
- Sampling to investigate the site/Ground in accordance with the Purpose, relevant code and Standard procedure
- Test at site to investigate the site/Ground in accordance with the Purpose, relevant code and Standard procedure
- List of equipment to be used while performing the Site investigation for self and for the safety of tools



- Data sheet enlisting the important features to interpret the site investigation data.

TOOLS AND EQUIPMENT'S

Measuring Tape	Standard cement cube molds
Metallic Tri-Square	Gauging trowel
Spirit level	Standard sieves for Fine aggregate tests
Steel scale	Standard sieves for coarse aggregate test
Weighing balance	Pycnometer
Weighing dishes	calibrated volume measure for density test,
Enameled trays	tamping rod
Desiccators	Brushes
Thermometers,	Funnels
Vernier calipers	Graduated glass measuring cylinders
Stopwatch	Slump cone Apparatus
Straight edge	compacting factor test apparatus
Static Cone Penetrometer Engine Driven	Flow table test apparatus
Vicat apparatus	Vee Bee test apparatus
Le-Chatelier apparatus	Compression testing machine
Le-Chatelier flask	Casagrande apparatus
Plastic limit test apparatus	Shrinkage test apparatus
Cylindrical metal container	heating oven
elongation gauge	flakiness gauge
Impact value apparatus	Marshall stability test apparatus
Speedy moisture meter apparatus	Skid Resistance /Abrasion value apparatus
Specific gravity bottle	mechanical sieve shaker
flash and fire point test apparatus	bitumen compactor
Soil auger	Sampling Outfit
Standard Penetration Test Apparatus	Split Spoon Sampler
Dynamic Cone Penetration Test Apparatus	Static Cone Penetrometer Hand Operated
Lab coat	Face Mask
Safety Helmets	Safety Shoes (Assorted size)
Safety goggles	Safety Apron
Hand gloves	Ear Plug



11.1.6. Observe Safety at Construction Site.

Overview: This competency standard covers the skills and knowledge required to work according to personal health, safety and environment protocol at construction site.

Competency Units	Performance Criteria
CU1. Maintain safe condition at work site	P1. Recognize the safety signs and symbols P2. Identify physical hazards at work site P3. Erect barricades hoardings, signage's in the hazardous areas P4. Identify the risk of slip, trip and fall at work place P5. Clean the effected floor P6. Remove obstacles from work area. P7. Perform fall protection measures as per job requirements P8. Label and store chemicals as per Material Safety Data Sheet (MSDS)
CU2. Select and wear the PPEs	P1. Identify risk associated with job to be done P2. Select appropriate PPEs for the purpose P3. Wear the PPEs P4. Demonstrate mock performance for doing the job.
CU3. Perform safety practices while using hand and power tools	P1. Select appropriate tools for specific to the job P2. Check physical working condition of the tools P3. Wear required PPEs P4. Assemble according to safety standards P5. Operate tools accordingly
CU4. Handle Loads (Manually)	P1. Judge the weight of load to be handle P2. Bend the knee while lifting as well as placing load manually P3. Check back bone straight during activity
CU5. Handle heavy load by chain hoist (Chain Pully)	P1. Judge the weight of load to be lifted P2. Select lifting equipment accordingly P3. Assemble the lifting equipment P4. Clamp the load with sling P5. Check load balance. P6. Operate chain pulley block without jerk P7. Use hand signal while lifting and placing load



CU6. Carried out basic first aid treatment	P1. Identify elements for first aid kit P2. Check expiry date of medicines P3. Perform first aid treatment for a mock bone fracture P4. Perform first aid treatment for a mock swear bleeding P5. Perform first aid treatment in simulated condition for eye injury
CU7. Perform fire fighting	P1. Identify type of fire P2. Select appropriate fire extinguishers P3. Check air direction P4. Perform spray on fire P5. Locate exist point
CU8. Perform emergency response activity	P1. Identify nature of emergency P2. Raise fire alarm P3. Inform rescue department P4. Control fire by fire extinguishers P5. Evacuate the work place P6. Gather the assembly point P7. Perform head count P8. Rescue the trapped injured person P9. Provide first aid to the rescue person
CU9. Ensure electricity safely at work place	P1. Check earthing of power equipment P2. Determine safest supply and route for electrical supply P3. Select leads and switch boards accordingly. P4. Conduct check on power board visually P5. Check leads and equipment for tags and visual damage P6. Report electrical hazards
CU10. Treat electric shock	P1. Turn off source of electricity P2. Move the victims away from source P3. Check responsiveness of the victims P4. Perform CPR procedure P5. Apply bandage on burn areas
CU11. Perform safe disposal of wastes	P1. Identify different type of waste bin P2. Segregate the waste P3. Handle the hazardous waste as per MSDS P4. Dispose of waste according to safety procedure.



Knowledge & Understanding.

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1** Explain the Importance of safety sign and symbols.
- K2** Explain different types of hazards involved at Site,
- K3** Identify unsafe act and unsafe conditions
- K4** Explain the risk register and enter the risks e.g. slip, trip and fall at work place.
- K5** Explain the importance to know prior history of accidents and cause.
- K6** Explain the importance to wear the PPEs according to safety standards.
- K7** State use of appropriate personal protective equipment for different situations.
- K8** State Safety relevant to tools, tackles, & requirement as per applicability.
- K9** Explain the importance of safety measures while using hand and power tools
- K10** State Basic ergonomic principles as per applicability.
- K11** Explain the difference between OHSAS 18001 and ISO 45001.
- K12** Explain the safety measures in accordance with the Safety standards
- K13** Define ISO 11228 Standard related to Manual handling:
- K14** Explain the standard practice of safety codes while handling the Load Manually.
- K15** Define ISO 16872 standard to handle the heavy load by Chain Hoist. Specifies the requirements for fine-tolerance hoist chains.
- K16** Explain the standard practice of safety codes while handling the heavy load by Chain Hoist
- K17** Define the ISO 7010-E003, first aid.
- K18** Describe First Aid process.
- K19** Explain the importance of first aid kit at construction sites according to standard code of practice.
- K20** Define ISO Standard ISO TC 21.
- K21** Explain the methods to perform firefighting according to safety standard.
- K22** Define ISO 22320 standard.
- K23** Explain Emergency safety control measures and actions to be taken under emergency situation
- K24** State Use of fire extinguisher.
- K25** State Reporting procedure to the concerned authority in emergency situations.
- K26** Explain the incident management process as per the standard.
- K27** Familiarize to the NFPA 70E Standard for Electrical Safety in The Workplace.
- K28** Explain management process Plan to make ensure the Electricity safety at work as per the standard.



- K29** Explain the Standard Methods to provide instantaneous response to treat the electric shock as per the standard procedures.
- K30** Explain the importance of safe work practice for self, persons and environment protection at Construction Sites.
- K31** State Standard procedure of handling, storing and stacking material
- K32** State Safe disposal of waste, type of waste and their disposal.
- K33** Explain the standards to dispose of the waste during execution at Construction Site.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Make sure not to create unsafe conditions for others
- List of PPEs for the different jobs according to safety standards.
- Keep floors dry and clean to avoid slipping while working with or around dangerous tools
- Group practice to handle load Manually according to safety standards.
- Risks while handling the heavy load by Chain Hoist according to safety standards.
- Process flow diagram to use a systematic approach in all medical emergencies
- Process diagram to perform the firefighting according to standards.
- Incident management Plan and Process flow Diagram.
- Identify safety risks that affect the health, safety and environment for self and others working in the vicinity, tackle it if within limit or report to appropriate authority
- Report because of violation and breaches of Electricity safety Plan for management to take corrective action.
- Process flow diagram to treat the Electric shock.
- Report for Management because of violation and breaches of safe disposal of wastes Plans.

TOOLS AND EQUIPMENT'S

1. Safety Helmets
2. Safety goggles
3. Hand gloves
4. Safety Shoes (Assorted size)
6. Ear Plug
8. Face mask
9. Board of Safety instructions.
10. Fire Extinguishers
11. First aid Kit



12. Stretcher
13. Safety harness
14. Safety Belts
15. Various hand / power tools
16. Fire Buckets.
17. Blankets
18. Chain Hoist
19. Hooks / Anchors
20. Slings
21. Safety net



11.2. Basic Drawing

11.2.1: Construct Scales for Drawing

Overview: This competency standard covers the skills and knowledge required to draw reducing scales in MKS and FPS Units.

Competency Units	Performance Criteria
CU-1. Construct a plain scale of RF 1: 5 and 1:20 showing metres and decimetres on half imperial drawing sheet.	P1. Observes local standards for basics of drawing. P2. Distribute space in required parts. P3. Draw scale of RF = 1:5 and 1:20 using principle of parallel lines. P4. Draw tile strip and title block for drawing sheet.
CU-2. Construct a plain scale of RF 1:6 and 1: 48 showing feet and inches on half imperial drawing sheet.	P1. Observes local standards for basics of drawing. P2. Distribute space in required parts. P3. Draw scale of RF = 1:6 and 1:48 using principle of parallel lines. P4. Draw tile strip and title block for drawing sheet.
CU-3. Construct a Diagonal scale of RF 1: 50 showing metres, decimetres and centimetres, of RF1:500 showing km, hectometres and decametres on A3 drawing sheet.	P1. Observes standards for basics of drawing. P2. Distribute space in required parts. P3. Draw scale of RF = 1:50 using principle of parallel lines and diagonals. P4. Draw scale of RF = 1:500 using principle of parallel lines and diagonals. P5. Draw tile strip and title block for drawing sheet.
CU-4. Construct a Diagonal scale of RF 1:36 showing yards, feet and inches, and of RF 1: 96 showing mile and furlong and 1/8 furlong on A3 drawing sheet.	P1. Observes standards for basics of drawing. P2. Distribute space in required parts. P3. Draw scale of RF = 1:36 using principle of parallel lines and diagonals. P4. Draw scale of RF = 1:96 using principle of parallel lines and diagonals. P5. Draw tile strip and title block for drawing sheet.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K-1. Scale, Scale Factor and R.F.



- K-2. Types of scales- Reducing scales, enlarging scales, full scale.
- K-3. Plane scales and diagonal scales.
- K-4. Open-ended scale and full divided scales
- K-5. Procedure of constructing plane scales.
- K-6. Procedure of constructing diagonal scales.

Critical Evidence(s) Required

The candidate needs to produce following critical evidences in order to competent in this competency standard.

- Drawing of letters on graph sheet in 4:5 & 4:7 ratio, double stroke, single stroke, upper case.
- Drawing of letters on half imperial sheet in 4:5 ratio, double stroke, single stroke, upper case and lower case lettering and printing.
- Drawing of letters on half imperial sheet in 4:7 ratio, double stroke, single stroke, upper case and lower case lettering and printing.

Instruments & Consumables

S No.	Description (Instruments)	S No.	Description (Consumable)
1	Drawing board	1	Drawing sheet
2	Tee square	2	Eraser
3	Pair of Set squares	3	HB, H, 2H, 3H Pencils
4	Drawing Box (Compasses, divider, protractor, rule)	4	Scotch tape
5	Sharpener/ Sand paper	5	Masking tape
6	Handkerchief		
7	French Curves		
8	Set of Card board scales		



11.2.2: Construct Geometrical Figures

Overview: This competency standard covers the skills and knowledge required to draw triangles, quadrilaterals, polygons- inscribed & circumscribed, draw prisms, draw pyramids, conic sections, circle, ellipse, parabola hyperbola and solid figures.

Competency Units	Performance Criteria
CU-1. Draw sketches of different types of triangles according to side length and angles free hand and to scale.	P1. Observes standards for basics of drawing. P2. Distribute space in required parts. P3. Draw equilateral triangle of side length 2". P4. Draw isosceles triangle with base 5 cm and height = 6 cm P5. Draw scalene triangle of lengths 2", 1.5", 1". P6. Draw acute angled triangle. P7. Draw right angles triangle. P8. Draw obtuse angled triangle. P9. Draw tile strip and title block for drawing sheet
CU-2. Draw sketches of polygons, circle, semi-circle, segment of circle, sector of circle and zone of circle free hand and to a scale.	P1. Observe local standards for basics of drawing. P2. Draw a regular pentagon of side length = 4 cm. P3. Draw hexagon inscribes in a circle and circumscribed about a circle of 3 inches diameter. P4. Draw circle, semi-circle, segment of circle, sector of circle and zone of circle of diameter 1.5 ". P5. Draw tile strip and title block for drawing sheet
CU-3. Draw sketches of all six types of quadrilaterals free hand to a scale	P1. Observes standards for basics of drawing. P2. Distribute space in required parts. P3. Draw square of side length 2". P4. Draw rectangle with length 5 cm and width= 3 cm P5. Draw rhombus of side length=2 cm and internal angle= 45° P6. Draw parallelogram of length 6 cm, width= 3 cm and internal angle= 45° P7. Draw trapezoid of parallel sides' length 4 cm and 6 cm spaced at a distance of 3 cm. P8. Draw trapezium of side lengths 5 cm, 4 cm, 6 cm and 3 cm. P9. Draw tile strip and title block for drawing sheet
CU-4. Draw conic sections with cutting plane at different angles	P1. Draw conic section resulting in a circle. P2. Draw conic section resulting in an ellipse. P3. Draw conic section resulting in a parabola.



	P4. Draw conic section resulting in a hyperbola.
CU-5. Draw full scale ellipses major axis = 10 cm and minor axis = 8 cm with four methods.	P1. Draw ellipse by four centers method. P2. Draw ellipse by basic method. P3. Draw ellipse by parallelogram method. P4. Draw ellipse by off-set method in concentric circles.
CU-6. Draw full scale parabola major axis = 10 cm and minor axis = 8 cm with four methods.	P1. Draw parabola by basic method. P2. Draw parabola by tangent method. P3. Draw parabola by rectangle method
CU-7. Draw sketches of prisms, cylinders, pyramids, cones in isometric views free hand and to a scale.	P1. Draw right and oblique rectangular prism. P2. Draw right and oblique cylinders. P3. Draw right and oblique hexagonal pyramids. P4. Draw right and oblique cones.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K-1.** State plane and solid figures.
- K-2.** Free hand sketching of plane figures and solid figures.
- K-3.** State the difference between plane and solid figure.
- K-4.** Draw free hand sketches of different plane and solid figures.
- K-5.** Describe the procedure for the construction of angles.
- K-6.** Describe different types of triangles, quadrilaterals and polygons.
- K-7.** State difference between inscribed and circumscribed figures.
- K-8.** State the terms used in a circle.
- K-9.** Sketch and label different lines and arcs in a circle.
- K-10.** Define ellipse and parabola
- K-11.** State cone, conical sections, (circle, parabola, ellipse and hyperbola).
- K-12.** Relate the conical sections in civil engineering drawings.
- K-13.** Explain the procedure of drawing plane and solid geometrical figures.
- K-14.** Explain the procedure of drawing ellipses & parabolas by different methods.

Critical Evidence(s) Required

The candidate needs to produce following critical evidences in order to competent in this competency standard.



- Construction of triangles, quadrilaterals, polygons- inscribed & circumscribed
- Drawings for prism Cylinders, pyramids, Cones, & different conical sections
- Drawings for circle, ellipse, parabola hyperbola and solid figures.

Instruments & Consumables

S No.	Description (Instruments)	S No.	Description (Consumable)
1	Drawing board	1	Drawing sheet
2	T square	2	Eraser
3	Pair of Set squares	3	HB, H, 2H, 3H Pencils
4	Drawing Box (Compasses, divider, protractor, rule)	4	Scotch tape
5	Sharpener/ Sand paper		
6	Handkerchief		
7	French Curves		
8	Set of Card board scales		



11.2.3: Produce Orthographic Projections

Overview: This competency standard covers the skills and knowledge required to draw orthographic projections, First angle projections, third angle projections of vee block, hollow concrete block, wooden cut blocks and draw missing view.

Competency Units	Performance Criteria
CU-1. Draw orthographic projections of Vee Block in first angle projection system.	P1. Apply basic operations on A3 size sheet and divide space. P2. Distribute space by calculations. P3. Draw front, top and side views v block with drawing instruments.
CU-2. Draw orthographic projections of hollow concrete Block in first angle projection system.	P1. Apply basic operations on A3 size sheet and divide space. P2. Distribute space by calculations. P3. Draw front, top and side view of hollow concrete block with drawing instruments.
CU-3. Draw orthographic projections of wooden cut block in first angle projection system.	P1. Apply basic operations on A3 size sheet and divide space. P2. Distribute space by calculations. P3. Draw front, top and side views wooden cut block with drawing instruments.
CU-4. Complete missing views when two views are given.	P1. Apply basic operations on A3 size sheet and divide space. P2. Distribute space by calculations. P3. Draw front, top and side views of missing views with drawing instruments.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K-1.** Define plane, principal plane.
- K-2.** Explain the principle of orthographic projection with simple sketches.
- K-3.** State the definition of projector and projection lines and their use.
- K-4.** State and differentiate between dihedral and trihedral angles.
- K-5.** State the types of orthographic projection.
- K-6.** Sketch the orthographic views of a simple engineering part of given pictorial drawing.
- K-7.** Identify the object from a number of orthographic views of the object.
- K-8.** Select the minimum number of views needed to fully represent a given object
- K-9.** Explain First & third angle projections for different 3-D objects



Critical Evidence(s) Required

The candidate needs to produce following critical evidences in order to competent in this competency standard.

- Drawing of First angle projections of Vee Block
- Drawing of third angle projections of hollow concrete block.
- Drawing of first angle & third angle projections of wooden cut blocks.
- Drawing of third angle projections of missing view.

Instruments & Consumables

S No.	Description (Instruments)	S No.	Description (Consumable)
1	Drawing board	1	Drawing sheet
2	T square	2	Eraser
3	Pair of Set squares	3	HB, H, 2H, 3H Pencils
4	Drawing Box (Compasses, divider, protractor, rule)	4	Scotch tape
5	Sharpener/ Sand paper		
6	Handkerchief		
7	French Curves		
8	Set of Card board scales		



11.2.4: Perform Dimensioning On Drawings

Overview: This competency standard covers the skills and knowledge required to dimension a drawing by adopting Uni-directional and bi-directional dimensioning, Base line dimensioning system, continuous dimensioning system, location dimensioning.

Competency Units	Performance Criteria
CU-1: Prepare a Dimensioned drawing by adopting Uni-directional and bi-directional dimensioning.	P1. Apply basic operations on A3 size sheet and divide space. P2. Distribute space by calculations. P3. Draw front, top and side views of Vee block. P4. Dimension the drawing Uni-directionally. P5. Dimension the drawing bi-directionally.
CU-2: Prepare a Dimensioned drawing by adopting Base line dimensioning system, continuous dimensioning system, location dimensioning.	P1. Apply basic operations on A3 size sheet and divide space. P2. Distribute space by calculations. P3. Draw front, top and side views of Vee block with holes. P4. Dimension the drawing as per base line dimensioning system. P5. Dimension the drawing as per continuous dimensioning system. P6. Dimension the drawing location of center of holes P7. Draw system of dimensioning P8. Draw dimensioning of holes P9. Draw dimensioning of arc P10. Draw dimensioning circles P11. Draw dimensioning of angles

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K-1.** Define Dimensioning.
- K-2.** State the need of dimensioning drawings according to accepted standards
- K-3.** State the dimension and extension line, arrow head, dimension, leader.
- K-4.** State the types of arrow head, length of arrowhead.
- K-5.** Identify the system of placement of dimensions of a given dimensioned drawing.
- K-6.** Describe Uni-directional and bi-directional dimensioning.
- K-7.** Define Base line dimensioning system, continuous dimensioning system, location dimensioning.
- K-8.** Draw dimension for location and size of holes, arcs, circles.
- K-9.** Dimension a given drawing using standard notations and desired system of dimensioning.

Critical Evidence(s) Required



The candidate needs to produce following critical evidences in order to competent in this competency standard.

- Dimensioned drawing by adopting Uni-directional and bi-directional dimensioning,
- Dimensioned drawing by Base line dimensioning system, continuous dimensioning system, location dimensioning.

Instruments & Consumables

S No.	Description (Instruments)	S No.	Description (Consumable)
1	Drawing board	1	Drawing sheet
2	T square	2	Eraser
3	Pair of Set squares	3	HB, H, 2H, 3H Pencils
4	Drawing Box (Compasses, divider, protractor, rule)	4	Scotch tape
5	Sharpener/ Sand paper		
6	Handkerchief		
7	French Curves		
8	Set of Card board scales		



11.2.5: Develop Symbols of Engineering Drawings

Overview: This competency standard covers the skills and knowledge required to prepare report on the health and safety considerations while preparing drawings, draw symbols of Engineering materials, components of building in plan, elevation & section, draw symbols of electrical installations, water supply installation, gas installations, sanitary installations.

Competency Units	Performance Criteria
CU-1: Investigate and prepare a short report on the health and safety considerations in preparing drawings.	P1. Observe Considerations: light (natural, artificial), P2. CAD (computer screens, electrical protection devices) P3. Observe neatness and cleanliness of drawing
CU-2: Draw symbols of engineering materials.	P1. Select the suitable instruments to draw symbols. P2. Distribute space of drawing sheet. P3. Draw symbols duly hatched as per local standards of Sand, ballasts, metals, timbers, soil-natural, cutting, filling, fabrics, rock, glass, ceramics, plastics and asbestos.
CU-3: Draw symbols of building components in plan, elevation, and section.	P1. Select the suitable instruments to draw symbols. P2. Distribute space of drawing sheet. P3. Draw symbols in plan, elevation, and section duly hatched as per local standards of brick work, stone work, block work, doors, windows, ventilators, RCC work, R.B. work, PCC, DPC, Lintels and stairs
CU-4: Draw symbols of electrical installations for ceiling and walls.	P1. Select the suitable instruments to draw symbols. P2. Distribute space of drawing sheet. P3. Draw symbols duly hatched as per local standards of energy meter, main switches, sub-main switches, circuit breakers, kit kat fuse, panel box, DFB, tube lights, holders, fans, bulbs, switches, socket, boards and circuit diagram
CU-5: Draw symbols of water supply and gas installations.	P1. Select the suitable instruments to draw symbols. P2. Distribute space of drawing sheet. P3. Draw symbols duly hatched as per local standards of water pipe lines, mixers, valves, cocks, taps, showers, pump, meter, cooler, gas pipe line, gas meter, gas heater, gas light, gas geezer and gas burner.
CU-6: Draw symbols of	P1. Select the suitable instruments to draw symbols.



sanitary installations.	P2. Distribute space of drawing sheet. P3. Draw symbols duly hatched as per local standards of- sewer lines, wash hand basins, water closets, bath tubs, urinals, sinks, dish washers, looking mirror, toilet paper holder, soap dish, shelf, towel rail, vent pipe, manhole, intercepting chambers, traps, and grating.
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Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K-1.** Define conventional symbols and give its importance.
- K-2.** Enlist and sketch symbols of engineering materials- Sand, ballasts, metals, timbers, soil- natural, cutting, filling, fabrics, rock, glass, ceramics, plastics and asbestos.
- K-3.** Enlist and sketch components of building in plan, elevation and section- brick work, stone work, block work, doors, windows, ventilators, RCC work, R.B. work, PCC, DPC, Lintels, stairs.
- K-4.** Enlist and sketch symbols of electrical installations- energy meter, main switches, sub-main switches, circuit breakers, kit kat, panel box, DFB, tube lights, holders, fans, bulbs, switches, socket, boards, circuit diagram.
- K-5.** Enlist and sketch water supply installation, gas installations- water pipe lines, mixers, valves, cocks, taps, showers, pump, meter, cooler. Gas pipe line, Gas meter, gas heater, gas light, gas geezer, gas burner.
- K-6.** Enlist and sketch sanitary installations- sewer lines, wash hand basins, water closets, bath tubs, urinals, sinks, dish washers, looking mirror, toilet paper holder, soap dish, shelf, towel rail, vent pipe, manhole, intercepting chambers, traps, grating.

Critical Evidence(s) Required

The candidate needs to produce following critical evidences in order to competent in this competency standard.

- Drawing symbols of Engineering materials.
- Drawing symbols of components of building in plan, elevation & section
- Drawing symbols of symbols of electrical installations
- Drawing symbols of water supply installation
- Drawing symbols of gas installations
- Drawing symbols of sanitary installations.



Instruments & Consumables

S No.	Description (Instruments)	S No.	Description (Consumable)
1	Drawing board	1	Drawing sheet
2	T square	2	Eraser
3	Pair of Set squares	3	HB, H, 2H, 3H Pencils
4	Drawing Box (Compasses, divider, protractor, rule)	4	Masking tape
5	Sharpener/ Sand paper		
6	Handkerchief		
7	French Curves		
8	Triangular scale		



11.2.6: Interpret Construction Plans/ coordinates.

Overview: This competency standard covers the skills and knowledge required to produce construction plan and interpret the coordinate system for taking samples from specific locations.

Competency Units	Performance Criteria
CU-1. Prepare construction plan of water supply and sanitary installations for A class bath on A4 sheet.	P1. Observe local standards for basics of drawing. P2. Distribute space in required parts. P3. Draw detailed plan. P4. Draw water supply installations. P5. Draw sanitary installations. P6. Perform dimensioning, lettering and printing of drawings. P7. Draw seal for drawing sheet.
CU-2. Prepare detailed plan of water supply gas and sanitary installations for C type residence on A3 sheet.	P1. Observe local standards for basics of drawing. P2. Distribute space in required parts. P3. Draw detailed plan of C type residence. P4. Draw water supply installations. P5. Draw gas installations. P6. Draw sanitary installations. P7. Prepare schedule of installations. P8. Perform dimensioning, lettering and printing of drawings. P9. Draw title strip for drawing sheet.
CU-3. Prepare detailed plan of electrical installations & Circuit diagram for C type residence on A3 sheet.	P1. Observe local standards for basics of drawing. P2. Distribute space in required parts. P3. Draw detailed plan of C type residence. P4. Draw electrical installations. P5. Draw Circuit diagram P6. Prepare schedule of installations. P7. Perform dimensioning, lettering and printing of drawings. P8. Draw title strip for drawing sheet.
CU-4. Interpret Coordinate system to locate place of collecting samples	P1. Observe local standards for basics of drawing. P2. Exercise rectangular coordinate system. P3. Exercise independent/absolute rectangular coordinates P4. Exercise relative rectangular coordinates P5. Mark rectangular coordinates on drawing of framed structure building. P6. Mark coordinates of a big building block.



P7. Mark coordinates of a complete construction site.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1. Define building services.
- K2. Enlist water supply, gas, sanitary & electricity installations for residential building.
- K3. Prepare schedule of different fixtures required for bath, kitchen, dining and courtyards.
- K4. Sketch the different fixtures in kitchen and bathrooms at their proper places.
- K5. Sketch the building services in C class residence at their proper places.
- K6. Understand coordinates system.
- K7. How to mark coordinates on drawing.
- K8. How to interpret coordinates for location of specific location.

Critical Evidence(s) Required

The candidate needs to produce following critical evidences in order to competent in this competency standard.

- Drawing of detailed plan for water supply, & sanitary installations of A class bath.
- Drawing of detailed plan for water supply, gas, & sanitary installations of A class kitchen.
- Drawing of detailed plan for water supply, gas & sanitary installations of C class residence.
- Drawing of detailed plan for electricity installations & circuit diagram in C class residence.
- Exercises of coordinate system on framed structure building, large building blok and on complete construction site.

Instruments & Consumables

S No.	Description (Instruments)	S No.	Description (Consumable)
1	Drawing board	1	Drawing sheet
2	T square	2	Eraser
3	Pair of Set squares	3	HB, H, 2H, 3H Pencils
4	Drawing Box (Compasses, divider, protractor, rule)	4	Scotch tape
5	Sharpener/ Sand paper		
6	Handkerchief		
7	French Curves		
8	Set of Card board scales		



11.3. Workshop Practices

11.3.1. Apply hand tools

Overview: This competency standard covers the skills and knowledge required to identify and select hand tools, apply wood tools and cleanup work site area.

Competency Units	Performance Criteria
CU1. Identify and select hand tools	P1. Identify and select hand, power and pneumatic tools, their functions, operations and limitations P2. Recognize OHS requirements for using hand tools
CU2. Apply wood tools	P1. Use appropriate hand tools to the task P2. Use suitable materials according to OHS requirements P3. Sharpen and maintain tools
CU3. Clean up the work site area	P1. Clear work area P2. Dispose off materials (reused or recycled) in accordance with legislation, regulations and codes of practice and job specification. P3. Clean, check, maintain and store tools according to requirement

Knowledge & Understanding

The candidate must be able to develop skills and understanding to assess risks, plan and prepare for safe work practices, maintain safety of self and others apply emergency response and cleanup work site area required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1. State categories of wood hand tools
- K2. Describe procedure of wood measuring & sawing tools
- K3. Describe procedure of wood marking tools
- K4. Describe procedure of wood holding tool
- K5. Describe procedure of cutting and drilling tool
- K6. Describe OHS requirements while using tools
- K7. Describe purpose and maintenance for clean up
- K8. Describe disposal of waste material and storing of tools



Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- marking, measuring, smoothing, drilling and sawing for timber section 2 in x 1.25 in length= 2 ft
- compliance to OHS requirements

Tools and Equipment

1. Sawing tools
2. Measuring tools
3. Marking tools
4. Holding tools
5. Cutting and drilling tools
6. Planning tools
7. PPEs
8. Dusting clothes
9. Mopes
10. Disposal box
11. Disposal bucket
12. Vipers
13. Brushes



11.3.2. Perform wooden joinery work

Overview: This competency standard covers the skills and knowledge required to make butt joint, biscuit joint, miter joint, edge joint, dovetail joint, dado joint mortise and tenon joint.

Competency Units	Performance Criteria
CU1. Make butt joints	P1. Identify butt joint P2. Cut timber according to requirement of butt joint P3. Join cut pieces according to requirement
CU2. Perform Biscuit joinery	P1. Identify biscuit joint P2. Cut timber according to requirement of biscuit joint P3. Join cut pieces according to requirement
CU3. Make Miter joints	P1. Identify Miter joints P2. Cut timber according to requirement of Miter joints P3. Join cut pieces according to requirement
CU4. Make Edge joint	P1. Identify Edge joint P2. Cut timber according to requirement of Edge joint P3. Join cut pieces according to requirement
CU5. Make Dovetail joint	P1. Identify Dovetail joint P2. Cut timber according to requirement of Dovetail joint P3. Join cut pieces according to requirement
CU6. Make Mortise and tenon joint	P1. Identify Mortise and tenon joint P2. Cut timber according to requirement of Mortise and tenon joint P3. Join cut pieces according to requirement
CU7. Make Dado joint	P1. Identify Dado joint P2. Cut timber according to requirement for Dado joint P3. Join cut pieces according to requirement

Knowledge & Understanding

The candidate must be able to develop skills and understanding make butt, biscuit, miter, edge, dovetail, mortise and tenon and dado joint required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1. State types of wood joints
- K2. Describe the uses of wood joints



- K3. Define Butt joint, Biscuit joint, Miter joint, Edge joint, Dovetail joint, Mortise and tenon joint, and Dado joint
- K4. Describe procedure for making a butt joint
- K5. Describe procedure for making a biscuit joint
- K6. Describe procedure for making a miter joint
- K7. Describe procedure for making an edge joint
- K8. Describe procedure for making a dovetail joint
- K9. Describe procedure for making a dado joint
- K10. Describe procedure for making a mortise & Tennon joint

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard observing the OHS requirements:

- make a butt joint and a biscuit joint,
- make a biscuit joint, and a miter joint
- Make an edge, dove tail joint and Tennon & Mortise joint.

Tools and Equipment

- ❖ Wood tool
- ❖ Measuring tool
- ❖ Marking tools
- ❖ Holding tool
- ❖ Cutting tool
- ❖ Planning tool



11.3.3. Apply fastenings

Overview: This competency standard covers the skills and knowledge required to prepare hole, identify and apply fastenings.

Competency Units	Performance Criteria
CU1. Prepare hole	P1. Identify and select power and pneumatic tools for making hole P2. Perform boring to make hole in accordance with OHS requirement
CU2. Identify fasteners	P1. Identify and select appropriate fasteners P2. Identify and select tools for fasteners
CU3. Apply fasteners	P1. Insert fasteners in hole prepared before P2. Use tools for fasteners

Knowledge & Understanding

The candidate must be able to develop skills and understanding to prepare hole, identify fastenings and apply fastenings required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1. State the types of power tools
- K2. Enlist the types of pneumatic tools
- K3. Explain the procedure for boring
- K4. Enlist the types of fasteners
- K5. State the uses of fasteners
- K6. Explain the procedure for inserting fasteners in hole

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Selection of appropriate fastening
- Install fastenings for Tennon & mortise joint, dado joint, butt joint, biscuit joint, mite joint, edge joint, and dovetail joint.
- Compliance to OHS requirement

Tools and Equipment

1. Fastening tools
2. Boring machine
3. Fastenings



11.3.4. Perform cutting, threading and reaming

Overview: This competency standard covers the skills and knowledge required to perform pipe cutting, its threading and reaming.

Competency Units	Performance Criteria
CU-1. Perform pipe cutting.	P1. Identify tools for cutting. P2. Secure work piece firmly P3. Measure required Length P3. Use cutter or Use Hacksaw P4. Loose the cutting Piece P6. Check length for cutting piece P7. Observe OHSA
CU-2. Perform pipe threading.	P1. Identify tools for threading. P2. Adopt safety measures P3. Fix work piece firmly P4. Clamp Threading die P5. Prepare threading P6. Unclamp the threading die P7. Observe OHSA
CU-3. Perform pipe reaming.	P1. Identify tools for Reaming. P2. Adopt safety measures P3. Fix work piece firmly P4. Clamp Threading pipe piece P5. Use reamer P6. Unclamp pipe piece P7. Observe OHSA

Knowledge & Understanding.

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1.** Comprehend the purpose and application of plumbing tools
- K2.** Explain the use of plumbing tools (pipe wrench, spanner, screw drivers, pipe cutters etc.)
- K3.** Explain the use of Plumbing equipment (Threading die, Hack Saw, Bench Vice, Leg Vice and reamer)
- K4.** Explain the procedure for use of plumbing tools (pipe wrench, spanner, screw drivers, pipe



cutters etc.)

- K5. Explain the procedure for use of Plumbing equipment (Threading die, Hack Saw, Bench Vice, Stand type Vice and reamer)
- K6. Explain safety precaution for using cutter and hacksaw
- K7. Describe calibration of tools.
- K8. Explain safety precaution for using tools
- K9. Explain different type of Dies
- K10. State work place clean up procedure

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- 1- Cutting pipes $\frac{1}{2}$ " dia, $\frac{3}{4}$ " dia and 1" dia to required length.
- 2- Threading pipes $\frac{1}{2}$ " dia, $\frac{3}{4}$ " dia and 1" dia
- 3- Reaming pipes $\frac{1}{2}$ " dia, $\frac{3}{4}$ " dia and 1" dia

TOOLS AND EQUIPMENT'S

- 1. Pipe wrench
- 2. Spanner
- 3. Screw drivers
- 4. Pipe cutters
- 5. Threading die for perform threading of $\frac{1}{2}$ " dia, $\frac{3}{4}$ " dia and 1" dia pipes
- 6. Hack Saw
- 7. Bench Vice
- 8. Stand type Vice
- 9. Reamers



11.3.5. Join pipes and fittings

Overview: This competency standard covers the skills and knowledge required to prepare for different type of pipe joints and it's fitting on residential and commercial plumbing works.

Competency Units	Performance Criteria
CU-1. Undertake pipe fitting and Installation	P1. Observe basic principles for pipe fittings P2. Identify and select materials for task P3. Identify tools and equipment for task P4. Attach Pipe with fittings P5. Locate fixtures properly P6. Undertake pipe leakage test P7. Use PPEs
CU-2. Install Hot and Cold Water Supply Pipes	P1. Observe basic principles for pipe fitting P2. Identify and select materials for task P3. Identify tools and equipment for task P4. Attach cold Pipe with fittings P5. Attach Hot Pipe with Geyser and fittings P6. Locate cross over properly P7. Locate drainage pipes P8. Undertake pipe leakage test P9. Use PPEs
CU-3. Join Cast Iron Pipes	P1. Place the spigot end of a pipe inside the bell end of another pipe making sure that both are clean and dry. P2. Inert the gasket into the hub of joint using yarning iron and then pack to the proper depth by using the packing iron. P3. Pour the molten lead into the joint up to the top of the hub. P4. Perform caulking after the lead has solidified and cooled P5. Align the pipe P6. Undertake pipe leakage test P7. Use PPEs
CU-4. Join G.I Pipes	P1. Observe basic principles for G.I. pipes P2. Select materials for task P3. Identify tools and equipment for task P4. Perform threading and cutting on pipes P5. Tight pipe with socket



	P6. Undertake pipe leakage test P9. Use PPEs
CU-5. Join PPRC Pipes	P-1 Observe basic principles for PPRC pipes P-2 Adopt safety measures P-3 Prepare welding machine with required dies of diameter. P-4 Cut the pipes at right angles to the pipe axis using suitable cutter. P-5 Remove any burrs or chips by cleaning the cutting area. P-6 Heat the pipe and fitting for welding for specified welding depth into the sleeves P-7 Join the pipe and fittings as per standards P-8 Undertake leakage test
CU-6. Join PVC Pipe	P1. Clean the ends of pipes to be joined. P2. Make one end of pipe should be cup/bell/ socket type if they are not in required shape. P3. Apply jointing solution in the bell/socket and over the spigot end P4. Insert the spigot end of a pipe into bell/socket of another pipe
CU-7. Join Concrete Pipes	P1. Correctly position and bed the first pipe. P2. Prepare the bedding for the second pipe. P3. Apply the seal on the spigot end. P4. Ensure the joint ring is not twisted and correctly located on spigot.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1- Knowledge of Safety requirements for installing cold and hot water pipes in residential buildings.
- K2. Knowledge of Fittings attach with hot water
- K3. Explain signs and symbols for Water supply system
- K4. Explain specifications for cold and hot water connections
- K5- Knowledge of faults in hot water pipes
- K6- Explain use of safety valves in geysers



K7. Explain the equipment for installing and fittings of pipes

K8. Explain drain Pipes

K9. Explain method for different type of pipe joints

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard observing OHS requirements:

- Join and test for Leakage of Hot & Cold-water connection with Geyser
- Join and Test for leakage for leakage of Cast Iron Pipe
- Join and Test for leakage for leakage of G.I. Pipe
- Join and Test for leakage for leakage of PPRC Pipe
- Join and Test for leakage for leakage of PVC Pipe
- Join and Test for leakage for leakage of Concrete Pipe

TOOLS AND EQUIPMENT'S

1. Pipe Benders,
2. Pipe Cutting Tools,
3. Deburrers,
4. Plumbing pliers,
5. Plumbing wrenches,
6. Plumbing spanners,
7. Pressure testing kits,
8. PPEs
9. Hot water fittings
10. Hot water accessories
11. G.I. & Cost Iron Pipes according to specifications
12. Pipe Vice
13. Hack Saw with blade
14. Different Fittings
15. Geyser
16. Safety Valve
17. Cost Iron Pipe
18. Lead
19. PPRC Pipe with fittings
20. Cocking Tools



11.3.6. Install plumbing fixtures

Overview: This competency standard covers the skills and knowledge required to install plumbing fixtures at work place i-e installation of water closet, flushing cistern, Wash hand Basin, English WC and Urinal

Competency Units	Performance Criteria
CU-1. Install Wash Hand Basin	P1. Identify safety requirements for installation P2. Identify tools for work P3. Identify Fixtures P4. Perform measurements P5. Mark out Installation point P6. Fix Pedestal by Drilling P7. Install Wash hand Basin P8. Fix Pillar cock, Rubber connection, waste pipes with coupling P9. Connect to drain pipe
CU-2. Install English water closet	P1. Mark out Installation point P2. Install the closet flange P3. Secure it to the subfloor P4. Connect outlet pipes with water supply P5. Perform final quality inspection P6. Check Level
CU-3. Install English water closet	P1. Mark out Installation point P2. Fix floor trap P3. Set WC at Level P4. Connect outlet pipes with water supply P5. Perform final quality inspection P6. Check Level P7. Use PPEs
CU-4. Install Flushing Cistern	P1. Mark out Installation point P2. Measure height for flushing cistern P3. Fix flushing pipe P4. Connect inlet pipe with water supply P5. Perform final quality inspection P6. Check Level P7. Use PPEs



CU-5. Install Urinal	P1. Mark out Installation point P2. Measure Height for flushing cistern P3. Fix Urinal with flushing pipe P4. Connect inlet pipe with water supply P5. Perform final quality inspection P6. Check Level P7. Use PPEs
CU-6. Install Sink	P1. Mark out Installation point P2. Measure height for sink P3. Fix sink fat trap with drain pipe P4. Connect inlet pipe with water supply P5. Perform final quality inspection P6. Check Level P7. Conduct Operational Testing P8. Use PPEs
CU-7. Install Bath Tub	P1. Mark out Installation point P2. Measure Height for bath tub P3. Set and level Bath Tub at designated place P4. Install a ledger board for supporting tub P5. Secure the tub to studs according to manufacturer instructions. P6. Attach drain to tub P7. Connect the overflow drain P8. Connect the drain pipe with P-trap P9. Connect inlet pipe with water supply P10. Perform leakage test P11. Perform Safety Precaution P12. Use PPEs

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1- Knowledge of water closet, Flushing Cistern with its types

K2- Use of tools and equipment's



- K3- Knowledge of joining techniques and with fixtures
- K4- Knowledge of levelling and fixing WC
- K5. Define WC with its types
- K6. Describe various trap fittings
- K7. Explain wash hand basin Pedestal type
- K8. Explain fitting procedure to install wash hand basin

Critical Evidence(s)

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Install Wash hand Basin with water cold & hot water connections.
- Install water closet Indian type and European type
- Install flushing cistern.
- Install wash Urinal with flushing cistern.
- Install Kitchen Sink & geyser
- Install Bath tub with water cold & hot water connections.

TOOLS AND EQUIPMENT'S

1. Pipe Benders,
2. Pipe Cutting Tools,
3. Pipe vice with stand,
4. Deburrers,
5. Plumbing pliers,
6. Plumbing wrenches,
7. Plumbing spanners,
8. Plungers,
9. Pressure testing kits,
10. Drill machine with drills.
11. PPEs
12. P-Trap
13. W.C (Indian & English)
14. Wash hand basin
15. Shower
16. Geyser
17. Bolt Kit
18. Screws
19. Clamps
20. Nails
21. Hammer and chisel
22. Bath Tub with accessories



- 23. Mallet
- 24. Urinal with fitting
- 25. Urinal Cistern
- 26. Tee cock
- 27. Basin mixer
- 28. Sink with mixer



11.3.7. Construct Sewers

Overview: This competency standard covers the skills and knowledge required to prepare and developed sewers pipes from buildings to lateral sewer. Soil stack pipes of cast iron called soil stack / vent pipes which are connected the sewers system.

Competency Units	Performance Criteria
CU-1. Plan and prepare for work	P1. Identify work place P2. Measure safety and other regulatory requirements P3. Interpret and confirm layout plan P4. Mark out excavation P5. Select tools and equipment P6. Use PPEs P7. Perform final quality inspection
CU-2. Interpret Plan for sewer construction	P1. Check for Safety Hazards P2. Perform excavation P3. Install trench support P4. Select material for construction P5. Perform bedding P6. Lay pipes and joints P7. Check hydraulic load P8. Perform Hydraulic test P9. Back filling and compaction
CU-3 Interpret Plan for soil stack pipe	P1. Check for Safety Hazards P2. Perform aligning and clamping P3. Select material P4. Perform joining and fixing P5. Check hydraulic load P6. Perform hydraulic test

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1- Knowledge of Safety requirements for installation of sewers
- K2- Knowledge of sewer joints with manholes
- K3- Explain different stages for sewer construction



- K4- Explain method to lay the sewer
- K5. Explain change of sewer line in case of breakage
- K6. Describe safety measures to lay sewer pipes
- K7. Explain PPEs with its importance
- K8. Explain soil stack pipes with its working

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard observing OHS requirements:

- Prepare plan for installation of sewers with its components
- Laying and jointing Concrete sewers
- Preform back filling of earth on sewer
- Install soil stack pipes of cost iron.

TOOLS AND EQUIPMENT'S

- ❖ Measuring tape
- ❖ Kassi
- ❖ String line
- ❖ Shovel
- ❖ Mortar pan
- ❖ Trowel
- ❖ Pipe testing unit complete
- ❖ Compactor
- ❖ Sprit level
- ❖ Umbrella (Optional)
- ❖ Trench side timbering
- ❖ Chain pulley
- ❖ Excavator and kassi, shovel
- ❖ Clamps
- ❖ Jointing rubber rings and cement mortar for pipes
- ❖ PPEs
- ❖ Cement mortar
- ❖ Calculator
- ❖ PPEs
- ❖ Trench digging tools



11.3.8. Perform Basic Electrical Installations

Overview: This competency standards covers the skills and knowledge required to prepare basic circuits and measurements, interpret electrical related drawing, provide power supply to machines & earthing thereof etc.

Competency Units	Performance Criteria
CU1. Perform Basic Electric Circuits	P1. Prepare series circuit on work bench using appropriate tools. P2. Prepare parallel circuit on work bench using appropriate tools. P3. Prepare series parallel circuit on work bench using appropriate tools. P4. Prepare Head and Tail Light Circuit on work bench using appropriate tools. P5. Prepare indicator circuit on work bench using appropriate tools.
CU2. Perform Basic Electrical Measurement	P1. Measure/ record voltage by using Digital Multi Meter (DMM) P2. Measure/ record current by using Digital Multi Meter (DMM) P3. Measure/ record resistance by using Digital Multi Meter. P4. Measure/ record continuity by using Digital Multi Meter.
CU3. Interpret Electrical layout	P1. Interpret layout of the job for installations P2. Interpret electrical drawing for electrical wirings P3. Follow drawing to connect components of equipment
CU4. Arrange Power Supply, Tools and Equipment	P1. Identify tools P2. Arrange tools and material as per job P3. Arrange work permit for the wiring task P4. Arrange backup resources for lighting, power and safety purposes as per job requirement
CU5. Provide Power Supply to machine	P1. Interpret electrical appliances P2. Coordinate with concerned departments before installations for feedback P3. Connect cables with machines as per operation manual P4. Verify the connections with respect to color coding / tagging / numbering.
CU6. Perform Earthing	P1. Identify earthing P2. Perform earthing of electrical appliances according to calculated load P3. Perform earth resistance test as per standards



Knowledge & Understanding

The candidate must be able to develop skills and understanding to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1. Describe electrical symbols to be used in drawings
- K2. Describe electrical wiring material.
- K3. Describe instruments tools used in electrical wiring.
- K4. Describe cleat wiring.
- K5. Describe types of current- AC and DC
- K6. State Ohm's Law
- K7. Interpret electrical circuit diagrams.
- K8. Explain handling techniques of electrical equipment
- K9. Describe the different methods of cable testing
- K10. Describe the use of digital multi-meter.
- K11. Describe methods of installing the electrical appliances
- K12. Describe basic knowledge of electrical appliances (A/C, water dispensers, microwave oven etc)
- K13. Describe the different types of coding procedures (e.g. colour coding / tagging / numbering)
- K14. Explain the procedure to provide power supply to machines.
- K15. Explain earthing and testing procedures
- K16. Describe working principle of earth tester
- K17. Understand L.C.R meter

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Construct Serial circuit, Parallel circuit, head & tail circuit and indicator circuit
- Measure voltage, current, resistance and check continuity by digital multimeter.
- Interpret drawing & connect a machine with power supply.
- Perform earthing and testing the same for machine

Tools and Equipment

- measuring tools (calipers, cable chart, measuring tape, for length),
- grinding cutter,
- drill machines,



- hammer
- side cutter,
- cable cutter,
- thimble presser,
- megger,
- stacker,
- conduits,
- laser gun
- PPEs
- Soldering material,
- earth tester,
- Digital multi meter,
- Soldering Iron
- Pliers
- hand hacksaw
- Wires
- Test bench (Complete accessories)
- Lamps