Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

PERFORM CEMENT TESTS

PWOCT401 **Perform cement tests**

Competence

RQF Level: 4

Learning Hours



60

Credits: 6

Sector: **Construction and Building Services**

Trade: **Public works**

Module Type: Specific

Curriculum: **CBSPWO4001-TVET Certificate IV in Public Work**

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<table>
<tr><td>Purpose statement</td><td colspan="6">This module describes the knowledge, skills, and attitudes required to perform cement tests. It is intended for learners pursuing RQF level IV in Public Works. At the end of this module, learners will be able to identify standard test method for cement tests and to perform setting time test, soundness test, cement compressive strength test, specific gravity test and Cement Bulk density test.</td></tr>
<tr><td>Learning assumed to be in place</td><td colspan="6">Full soil identification and In situ dry density test</td></tr>
<tr><td rowspan="6">Delivery modality</td><td colspan="2">Training delivery</td><td>100%</td><td colspan="2">Assessment</td><td>Total 100%</td></tr>
<tr><td colspan="2">Theoretical content</td><td>30%</td><td rowspan="4">Formative assessment</td><td>30%</td><td rowspan="4">50%</td></tr>
<tr><td colspan="2">Practical work:</td><td rowspan="3">70%</td><td rowspan="3">70%</td></tr>
<tr><td>• Group work and presentation</td><td>30%</td></tr>
<tr><td>• Individual work</td><td>40%</td></tr>
<tr><td colspan="2"></td><td colspan="2">Summative Assessment</td><td>50%</td></tr>
</table>

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. Perform standard consistency test of cement	1.1. Test standard methods are clearly selected as per requirements
	1.2. Tools, materials and equipment are clearly selected as per standards
	1.3. Standard consistency test materials are properly sampled as per standards
	1.4. Standard consistency test results are correctly analyzed as per standards
	1.5. Standard consistency test report is properly elaborated as per standard
2. Perform setting time test	2.1. Test standard methods are clearly selected as per requirements
	2.2. Tools, materials and equipment are clearly selected as per standards
	2.3. Setting time test materials are properly sampled as per standards
	2.4. Setting time test results are properly analyzed as per standards

	2.5. Setting time test report is properly elaborated as per standards
3. Perform soundness test	3.1. Test standard methods are clearly selected as per requirements
	3.2. Tools and equipment are clearly selected as per standards
	3.3. Soundness test samples are properly sampled as per standards
	3.4. Soundness test results are properly analyzed as per standards
	3.5. Soundness test report is properly elaborated as per standards
4. Perform cement compressive strength test	4.1. Test standard methods are clearly selected as per standards
	4.2. Tools, Materials and equipment are properly selected as per standards
	4.3. Compressive strength test samples are properly sampled as per standards
	4.4. Compressive strength test samples are properly prepared as per standards
	4.5. Compressive strength test results are effectively analyzed as per standards
	4.6. Compressive strength test report is properly elaborated as per standards.
5. Perform specific gravity test	5.1. Test standard methods are properly selected as per requirements
	5.2. Tools, Materials and equipment are properly selected as per standards
	5.3. Specific gravity test samples are properly sampled as per standards
	5.4. Specific gravity test results are properly analyzed as per standards
	5.5. Specific gravity test report is properly elaborated
6. Perform Cement Bulk density test	6.1. Test standard methods are properly selected as per requirements
	6.2. Tools, Materials and equipment are properly selected as per standards
	6.3. Bulk density test samples are properly sampled as per standards
	6.4. Bulk density test results are properly analyzed as per standards

	6.5. Bulk density test report is properly elaborated as per standards

Intended Knowledge, Skills, and Attitude

Knowledge	Skills	Attitude
✓ Identify Test methods and standards of cement ✓ Discuss cement types and properties ✓ Explain thermochemistry ✓ Interpret Mechanical Physics ✓ Determine the quantities of required cement ✓ Differentiate laboratory tools and equipment ✓ Identify units of measurement	✓ Apply ICT in reporting ✓ Take sample for test ✓ Perform standard consistency test of cement ✓ Perform setting time test ✓ Perform soundness test ✓ Perform cement compressive strength test ✓ Perform specific gravity test ✓ Perform Cement Bulk density test ✓ Analyze cement test results ✓ Report the work done	✓ Communicate actively at workplace ✓ Demonstrate professionalism in taking samples ✓ Pay attention in performing tests ✓ Respect time in reporting the work done

Course Content

Learning outcomes	At the end of the module the learner will be able to: 1. Perform standard consistency test of cement 2. Perform setting time test 3. Perform soundness test 4. Perform cement compressive strength test

	5. Perform specific gravity test 6. Perform Cement Bulk density test
Learning outcome 1: Perform standard consistency test of cement	**Learning hours: 12**

Indicative content

- **Selection of standards test method**
  - ✓ Definition of terms used for Cement consistency test
  - ✓ Applicable standards
  - ✓ Purpose of Cement consistency test
  - ✓ Applications of Cement consistency test
- **Selection of tools, materials and equipment**
  - ✓ Class of tools
  - ✓ Class of equipment
  - ✓ Types of materials
- **Sampling of materials for Cement consistency test**
  - ✓ Techniques of sampling
  - ✓ Characteristics of sample
- **Analysis of Cement consistency test data**
  - ✓ Cement consistency test procedures
  - ✓ Calculation of Cement consistency value
- **Reporting Cement consistency test results**
  - ✓ Identification of report elements
  - ✓ Elaboration of test report

Resources required for the learning outcome

Equipment	Vicat apparatus, balance, stop watch, printer, projector, white board and computer
Materials	Cement, water, pen/pencils, notebook, internet, books, log sheet
Tools	Measuring cylinder, glace plate, tray, trowel, scoop, tape measure, and ruler.
Facilitation techniques	Brainstorming, Demonstration and simulation, Individual and group work Practical exercise, Trainer guided ,Group discussion
Formative assessment methods /(CAT)	Written assessment, Oral presentation, Performance assessment, Project based assessment.

Learning outcome 2: Perform setting time test	Learning hours: 7

Indicative content

- **Selection of standards test method**
  - ✓ Definition of terms used for Cement setting time test
  - ✓ Applicable standards
  - ✓ Purpose of Cement setting time test
  - ✓ Application of Cement setting time test
- **Selection of tools, materials and equipment**
  - ✓ Classes of tools
  - ✓ Classes of equipment
  - ✓ Types of materials
- **Sampling of materials for Cement setting time test**
  - ✓ Techniques of sampling
  - ✓ Characteristics of sample
- **Analysis of Cement setting time test data**
  - ✓ Cement setting time test procedures
  - ✓ Calculation of Cement setting time value
- **Reporting Cement setting time test results**
  - ✓ Identification of report elements
  - ✓ Elaboration of test report

Resources required for the learning outcome

Equipment	Vicat apparatus, balance, stop watch, printer, projector, white board and computer
Materials	Cement, water, pen/pencils, notebook, internet, books, log sheet, internet
Tools	Measuring cylinder, glace plate, tray, trowel, scoop, tape measure and ruler
Facilitation techniques	Brainstorming, Demonstration and simulation, Individual and group work Practical exercise, Trainer guided ,Group discussion
Formative assessment methods /(CAT)	Written assessment, Oral presentation, Performance assessment, Project based assessment.

Learning outcome 3: Perform Cement soundness test	Learning hours: 12
Indicative content	
• **Selection of standards test methods** ✓ Definition of terms used for Cement soundness test ✓ Purpose of Cement soundnesstest ✓ Applications of Cement soundnesstest ✓ Types of standards test method and application • **Selection of Tools, materials and equipment** ✓ Classes of tools ✓ Classes of equipment ✓ Types of materials • **Sampling of materials for Cement soundnesstest** ✓ Techniques of sampling ✓ Characteristics of sample • **Analysis of Cement soundness test data** ✓ Cement soundnesstest procedures ✓ Calculation of Cement soundnessvalue • **Reporting Cement soundness test results** ✓ Identification of report elements ✓ Elaboration of test report	
Resources required for the learning outcome	
Equipment	Le-chatelier mould Apparatus, water bath, Printer, Computer, mixer, Balance, white board, chalkboard, printer, stop watch and projector.
Materials	Cement, water, weight, pen/pencils, notebook, internet, books, log sheet, internet
Tools	Brushes, Glace plate, trowel, mixing pan , hand shovel, tape measure, ruler, bowl
Facilitation techniques	Brainstorm, Demonstration and simulation, Individual and group work Practical exercise, Trainer guided ,Group discussion
Formative assessment methods /(CAT)	Written assessment, Oral presentation, Performance assessment, Project based assessment.

Learning outcome 4: Perform cement compressive strength test	Learning hours: 7

Indicative content

- **Selection of standards test method**
  - ✓ Definition of terms used for Cement compressive strength test
  - ✓ Applicable standards
  - ✓ Purpose of Cement compressive strength test
  - ✓ Applications of Cement compressive strength test
- **Selection of tools, materials and equipment**
  - ✓ Classes of tools
  - ✓ Classes of equipment
  - ✓ Types of materials
- **Sampling of materials for cement compressive strength test**
  - ✓ Techniques of sampling
  - ✓ Characteristics of sample
- **Sample preparation for cement compressive strength test**
  - ✓ Sample size
  - ✓ Sample quartering
  - ✓ Mixing procedures of materials for Cement compressive strength test
- **Analysis of cement compressive strength test data**
  - ✓ Cement compressive strength test procedures
  - ✓ Calculation of Cement compressive strength value
- **Reporting cement compressive strength test results**
  - ✓ Identification of report elements
  - ✓ Elaboration of test report

Resources required for the learning outcome

Equipment	Compressive test machine, vibrator, Computers, printer, Balance, white board, chalkboard
Materials	Cement, standard sand, water, pen/pencils, notebook, internet, books, log sheet, internet
Tools	Moulds, tamping rod, tray, trowel, tape measure, and ruler

Facilitation techniques	Brainstorm, Demonstration and simulation, Individual and group work Practical exercise, Individualized, Trainer guided ,Group discussion
Formative assessment methods /(CAT)	Written assessment, Oral presentation, Performance assessment, Project based assessment.

Learning outcome 5: Perform specific gravity test	**Learning hours: 12**
Indicative content	

- **Selection of standards test method**
  - ✓ Definition of terms used for Cement specific gravity test
  - ✓ Applicable standards
  - ✓ Purpose of Cement specific gravity test
  - ✓ Applications of Cement specific gravity test
- **Selection of Tools, materials and equipment**
  - ✓ Classes of tools
  - ✓ Classes of equipment
  - ✓ Types of materials
- **Sampling of materials for Cement specific gravity test**
  - ✓ Techniques of sampling
  - ✓ Characteristics of sample
- **Analysis of Cement specific gravity test data**
  - ✓ Cement soundness test procedures
  - ✓ Calculation of Cement specific gravity value
- **Reporting Cement specific gravity test results**
  - ✓ Identification of report elements
  - ✓ Elaboration of test report

Resources required for the learning outcome

Equipment	Le-chatelier flask, glass funnel, balance.
Materials	Cement, kerosene, pen/pencils, notebook, internet, books, log sheet, internet
Tools	Tape measure and ruler
Facilitation techniques	Brainstorm, Demonstration and simulation, Individual and group work

	Practical exercise, Trainer guided ,Group discussion
Formative assessment methods /(CAT)	Written assessment, Oral presentation, Performance assessment, Project based assessment.

Learning outcome 6: Perform Cement Bulk density test	**Learning hours:10**
Indicative content	

- **Selection of standards test method**
  - ✓ Definition of terms used for Cement Bulk density test
  - ✓ Applicable standards
  - ✓ Purpose of Cement Bulk density test
  - ✓ Applications of Cement Bulk density test
- **Selection of tools, materials and equipment**
  - ✓ Classes of tools
  - ✓ Classes of equipment
  - ✓ Types of materials
- **Sampling of materials for Cement Bulk density test**
  - ✓ Techniques of sampling
  - ✓ Characteristics of sample
- **Analysis of Cement Bulk density test data**
  - ✓ Cement Bulk density test procedures
  - ✓ Calculation of Bulk density value
- **Reporting Cement Bulk density test results**
  - ✓ Identification of report elements
  - ✓ Elaboration of test report

Resources required for the learning outcome

Equipment	Sieve funnel with tripod
Materials	Cement, water, pen/pencils, notebook, internet, books, log sheet, internet
Tools	Spatula, scoop, tape measure, and ruler
Facilitation techniques	Brainstorm, Demonstration and simulation, Individual and group work Practical exercise, Individualized, Trainer guided ,Group discussion
Formative assessment methods /(CAT)	Written assessment, Oral presentation, Performance assessment, Project based assessment.

Integrated/Summative assessment

Rwanda Standard Bureau (RSB) in collaboration with Rwanda Housing Authority (RHA) have the project of 3 months to validate the quality of local and imported Construction materials including cements that are used in construction of local public works. The concerned cements to be tested are PRIME Cement, NYATI Cement, HIMA Cement, TWIGA Cement and CIMERWA Cement.

The client hired you as lab technician to perform Cement laboratory tests of Standard consistency test, setting time test, soundness test, cement compressive strength test, specific gravity test and Cement for each cement type. The client has also recommended use ASTM (American Standard Testing Method)

Instructions:

- Duration: 10 days
- Recommended Standard by Client: ASTM (American Standard Testing Method)
- Cleanliness of tools & equipment and workplace work is a must
- All facilities required for task performance, are provided

Resources

Tools	Measuring cylinder, Glace Plate, Tray, Trowel, Tape measure, Ruler, Brushes, Mixing pan, Hand shovel, Bowl, Spatula, Scoop, Sieve panel with tripod
Equipment	Vicat apparatus, computer, printer, Balance, Le-chatelier apparatus, Le-chatelier flask, Water bath, Mixer, Compressive test machine, Vibrator, Moulds, Taping rods, Glass panel
Materials/ Consumables	Pen ,Paper, Laboratory , cement, Water ,Weight , Log sheet, Kerosene

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
1. Perform standard consistency test of cement (15%)	Test standard is clearly selected per as requirement	Standard test is selected			1
	Tools, Materials and equipment are clearly selected	Materials are selected			1
		Tools are selected			1
		Equipment are selected			2

	Standard consistency test Materials are properly Sampled as per standards	Sampling technique is selected			2
		Sampling technique is respected			2
		Sample to be used is determined			2
	Standard consistency test results are correctly analyzed as per standards	%of water to be used is determined			3
		Water and cement are mixed			2
		Cement paste is filled in Vicat			2
		Cement consistency value is calculated			1
	Standard consistency test report is properly elaborated as per standard	All report elements are identified			1
		Testing report is elaborated			2
2. Perform setting time test **(15%)**	Test standard methods are clearly selected per as requirements	Type of Standard test method is selected			1
	Tools and equipment are clearly selected per as task	Tools are selected			2
		Materials are selected			1
		Equipment are selected			2
	Setting time test Materials are properly Sampled as per standards	Sampling technique is applied			1
	Setting time test results are properly analyzed as per standards	Setting time test procedures are done			2
		Cement Setting time value is calculated			1
	Setting time test report	All report elements are			2

	is properly elaborated as per standards	identified			
		Testing report is elaborated			2
3. Perform soundness test **(15%)**	Test standard methods are clearly selected as per requirements	Type of Standard test method is selected			1
	Tools, materials and equipment are clearly selected as per standards	Tools are selected			2
		Materials are selected			1
		Equipment are selected			2
	Soundness test sample are properly sampled as per standards	Sampling technique is applied			1
	Soundness test results are properly analyzed as per standards	Test procedures are performed			2
		Soundness test value is calculated			2
	Soundness test report is properly elaborated as per standards	All report elements are identified			1
		Testing report is elaborated			2
4. Perform cement compressive strength test **(25%)**	Test standard is clearly selected as per standards	Standard test is selected			1
	Tools, materials and equipment are properly selected as per standards	Tools are selected			2
		Materials are selected			2
		Equipment are selected			2
	Compressive strength test samples are	Sampling technique is			1

	properly sampled as per standards	applied			
	Compressive strength test samples are properly prepared as per standards	Sample size is prepared			1
		Sample quartering is prepared			1
		Mixing procedures of materials is done			2
	Compressive strength test results are effectively analyzed as per standards	Cement compressive strength test is performed			2
		Cement compressive strength value is calculated			2
	Compressive strength test report is properly elaborated as per standards.	All report elements are identified			2
		Testing report is elaborated			3
5. Perform specific gravity test **(15%)**	Test standard methods are properly identified as per requirements	Type of Standard test method is selected			1
	Tools, materials and equipment are properly selected as per standards	Tools are selected			2
		Materials are selected			1
		Equipment are selected			2
	Specific gravity test samples are properly sampled as per standards	Sampling technique is applied			1
	Specific gravity test results are properly analyzed as per standards	Cement soundness test procedures are performed			2
		Cement specific gravity value is calculated			2
	Specific gravity test report is properly	All report elements are			1

	elaborated	identified			
		Testing report is elaborated			2
6. Perform Cement Bulk density test (15%)	Test standard methods are properly Selected as per requirements	Type of Standard test method is selected			1
	Tools, materials and equipment are properly selected as per standards	Tools are selected			2
		Materials are selected			1
		Equipment are selected			2
	Bulk density test samples are properly sampled as per standards	Sampling technique is applied			1
	Bulk density test results are properly analyzed as per standards	Cement Bulk density test procedures are performed			3
		Bulk density value is calculated.			2
	Bulk density test report is properly elaborated as per standards	All report elements are identified			1
		Testing report is elaborated			2
Total marks					100
Percentage Weightage					100%
Minimum Passing line % (Aggregate):					70%

References

1. Sabins, F. L., & D. L. Sutton. (1991). Interrelationship between Critical Cement Properties and Volume Changes during Cement Setting.
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4. Forde, P. M. (2011). *Construction and Building Materials.* , Kidlington: Elsevier.
5. Kett, I. (2017). Engineered Concrete: Mix Design and Test Methods, Second Edition.