Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

AGGREGATES' TESTS

PWOAT401

Perform Aggregates' Tests

RQF Level: 4

Learning Hours 90

Credits: 9

Sector: Construction and Building Services

Trade: Public Works

Module Type: Specific

Curriculum: CBSPWO4001-TVET Certificate IV in Public Works

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<table>
<tr><td>Purpose statement</td><td colspan="6">This module describes the knowledge, skills, and attitudes required to test aggregates. It is intended for learners pursuing RQF level IV in Public Works. At the end of this module the learners will be able to perform sand equivalent test, perform flakiness index and elongation test, perform aggregate crushing value test, perform aggregates impact value test, perform Los Angeles abrasion test and perform coarse aggregate water absorption test.</td></tr>
<tr><td>Learning assumed to be in place</td><td colspan="6">N/A</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>
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Elements of Competency and Performance Criteria

Elements of competence	Performance criteria
1. Perform Sand Equivalent Test	1.1. Standard test method is properly identified according to the material to be tested.
	1.2. Tools and equipment are properly selected in reference with the standards.
	1.3. Fine aggregates are correctly sampled in reference with the standards.
	1.4. Fine aggregates are properly prepared in reference with the standards.
	1.5. Sand equivalent test procedure is properly performed in accordance with the standards
	1.6. Sand equivalent test data are correctly analyzed in accordance with the recorded data.
	1.7. Sand equivalent test results are properly reported in accordance with the

	standard.
2. Perform Flakiness Index and Elongation Test	2.1. Standard test method is properly identified according to the material to be tested.
	2.2. Tools and equipment are properly selected in reference with the standard.
	2.3. Coarse aggregates sample are correctly sampled in reference with the standard.
	2.4. Coarse aggregates are properly prepared in reference with the standard.
	2.5. Flakiness index and elongation test procedure is properly performed in accordance with the standards
	2.6. Flakiness index and elongation test data are correctly analyzed in accordance with the recorded data.
	2.7. Flakiness index and elongation value test results are properly reported in accordance with the standards.
3. Perform Aggregate Crushing Value Test	3.1. Standard test method is properly identified according to the material to be tested.
	3.2. Tools and equipment are properly selected in reference with the standard.
	3.3. Coarse aggregates sample are correctly sampled in reference with the standards.
	3.4. Coarse aggregates are properly prepared in reference with the standards.
	3.5. Aggregate crushing value test procedure is properly performed in accordance with the standards
	3.6. Aggregate crushing value test data are correctly analyses accordance with the recorded data.
	3.7. Aggregate crushing value test results are properly reported in accordance with the standards.

4. Perform Aggregates Impact Value Test	4.1. Standard test method is properly identified according to the material to be tested.
	4.2. Tools and equipment are properly selected in reference with the standards.
	4.3. Coarse aggregates sample are correctly sampled in reference with the standards.
	4.4. Coarse aggregates are properly prepared in reference with the standards.
	4.5. Aggregates impact value test procedure is properly performed in accordance with the standards
	4.6. Aggregates impact value test of coarse aggregates are adequately determined in accordance with the standards.
	4.7. Aggregates impact value test results are properly reported in accordance with the standards.
5. Perform Los Angeles Test	5.1. Standard test method is properly identified according to the material to be tested.
	5.2. Tools and equipment are properly selected in reference with the standards.
	5.3. Coarse aggregates sample are correctly sampled in reference with the standards.
	5.4. Coarse aggregates are properly prepared in reference with the standards.
	5.5. Los Angeles abrasion test procedure is properly performed in accordance with the standards
	5.6. Los Angeles abrasion test data are correctly analyzed in accordance with the recorded data.
	5.7. Los Angeles abrasion test data test results are properly reported in accordance with the standards.
6. Perform Coarse	6.1. Standard test methods are properly identified according to the material to

Aggregate Water Absorption Test	be tested.
	6.2. Tools and equipment are properly selected in reference with the standards.
	6.3. Coarse aggregates sample are correctly sampled in reference with the standards.
	6.4. Coarse aggregates are properly prepared in reference with the standards.
	6.5. Water absorption test procedure is properly performed in accordance with the standards
	6.6. Water absorption test data are correctly analysed in accordance with the recorded data.
	6.7. Water absorption test data test results are properly reported in accordance with the standards.

Intended Knowledge, Skills and Attitude

Knowledge	Skills	Attitude

✓ Identify different methods of testing aggregates ✓ Classify laboratory tools and equipment ✓ Describe characteristics of aggregates ✓ Discuss aggregates types and properties ✓ Determine quantities of samples required ✓ Identify units of measurement	✓ Take Sample ✓ Perform Sand Equivalent Test ✓ Perform Flakiness Index And Elongation Test ✓ Perform Aggregate Crushing Value Test ✓ Perform Aggregates Impact Value Test ✓ Perform Los Angeles Test ✓ Perform Coarse Aggregate Water Absorption Test ✓ Analyze test results ✓ Report aggregate test results ✓ Apply ITC in reporting	✓ Communicate actively at workplace ✓ Demonstrate professionalism in taking samples ✓ Be careful while carrying out aggregate tests ✓ Respect time in reporting the aggregate test results

Course content

Learning outcomes	At the end of the module the learner will be able to: 1. Perform sand equivalent test 2. Perform flakiness index and elongation test 3. Perform aggregate crushing value test 4. Perform aggregates impact value test 5. Perform Los Angeles abrasion test 6. Perform coarse aggregate water absorption test
Learning outcome 1: Perform sand equivalent test	**Learning hours: 15**

Indicative content
• **Identification of standard test methods** ✓ Definitions of terms used for sand equivalent test ✓ Purpose of sand equivalent test ✓ Applications of sand equivalent test ✓ Applicable standards • **Selection of tools, materials and equipment** ✓ Class of tools ✓ Class of equipment ✓ Types of material • **Sampling of fine aggregate material** ✓ Techniques of sampling ✓ Characteristics of sample • **Preparation of fine aggregate sample** ✓ Sample size ✓ Sample quartering • **Analysis of sand equivalent test data** ✓ Sand equivalent test procedures ✓ Calculation of sand equivalent value • **Reporting sand equivalent test results** ✓ Identification of report elements ✓ Elaboration of test report

Resources required for the learning outcome	
Equipment	Graduated plastic cylinder, rubber stopper, irrigator tube, weighted foot assembly, and siphon assembly, glass or plastic container with cover, siphon, discharge tube, Sand Equivalent Shaker, projector, computer, balance, printer, white board, chalkboard, Sieve set, PPE
Materials	Calcium chloride solution, distilled or deionized water, paper, flip chat, marker pens, pens, pencils, books, internet, chalks, duster, water.
Tools	Scoop, pan, ruler, timer, barrel brush,
Facilitation techniques	Brainstorming, demonstration and simulation, individual and group work, practical exercise, trainer guided and group discussion, Four steps
Formative assessment methods /(CAT)	Written assessment, oral presentation, performance assessment, Project based assessment

Learning outcome 2: Perform flakiness index and elongation test	Learning hours: 15

Indicative content

- **Identification of flakiness index and elongation standard test methods**
  - ✓ Definition of terms used for flakiness index and elongation test
  - ✓ Applicable standards
  - ✓ Purpose of flakiness index and elongation test
  - ✓ Applications of flakiness index and elongation test
- **Selection of tools, materials and equipment**
  - ✓ Classes of tools
  - ✓ Classes of equipment
  - ✓ Types of material
- **Sampling of coarse aggregate material**
  - ✓ Techniques of sampling
  - ✓ Characteristics of sample
- **Preparation of coarse aggregate sample**
  - ✓ Sample size
  - ✓ Sample quartering
- **Analysis of flakiness index and elongation data.**
  - ✓ flakiness index and elongation test procedures
  - ✓ Calculating flakiness index
  - ✓ Calculating elongation index
- **Reporting flakiness index and elongation test results**
  - ✓ Identification of reports elements
  - ✓ Elaboration of test report

Resources required for the learning outcome

Equipment	Thickness gauge, balance, length gauges, sieve, projector, computer, white boards, chalkboard, sieve shaker, Oven, metal tray, PPE
Materials	flip chat, pen, paper, marker pens, aggregate, water
Tools	Pan, scoop, brush, calculator
Facilitation techniques	Brainstorming, demonstration and simulation, individual and group work, practical exercise, Individualized, trainer guided and group discussion, Four steps

Formative assessment methods /(CAT)	Written assessment, oral presentation, performance assessment, Project based assessment

Learning outcome 3: Perform aggregate crushing value test	**Learning hours: 15**

Indicative content

- **Identification of aggregate crushing value standard test methods**
  - ✓ Definitions of terms used for aggregate crushing value test
  - ✓ Applicable standards
  - ✓ Purpose of aggregate crushing value test
  - ✓ Applications of aggregate crushing value test
- **Selection of tools, materials and equipment**
  - ✓ Classes of tools
  - ✓ Classes of equipment
  - ✓ Types of material
- **Sampling of coarse aggregate material**
  - ✓ Techniques of sampling
  - ✓ Characteristics of sample
- **Preparation of coarse aggregate sample**
  - ✓ Sample size
  - ✓ Sample quartering
- **Analysis of aggregate crushing value data.**
  - ✓ Aggregate crushing value test procedures
  - ✓ Calculate aggregate crushing value
- **Reporting aggregate crushing value test results**
  - ✓ Identification of reports elements
  - ✓ Elaboration of test report

Resources required for the learning outcome

Equipment	Balance, sieve, mould, measuring cylinder, plunger, steel cylinder, base plate, tamping rod, compression machine, projector, computer, PPE
Materials	Samples, papers, marker pens, pens, pencils, books, flip chat, white board, black board

Tools	Scoop, tamping rod, pan, metal tray, calculator
Facilitation techniques	Brainstorming, demonstration and simulation, individual and group work, practical exercise, Individualized, trainer guided and group discussion, Four steps
Formative assessment methods /(CAT)	Written assessment, oral presentation, performance assessment, Project based assessment

Learning outcome 4: Perform aggregate impact value test	**Learning hours: 15**
Indicative content	

- **Identification of aggregate impact value standard test methods**
  - ✓ Definition of terms used for aggregate impact value test
  - ✓ Applicable standards
  - ✓ Purpose of aggregate impact value test
  - ✓ Applications of aggregate impact value test
- **Selection of tools, materials and equipment**
  - ✓ Classes of tools
  - ✓ Classes of equipment
  - ✓ Types of material
- **Sampling of coarse aggregate material**
  - ✓ Techniques of sampling
  - ✓ Characteristics of sample
- **Preparation of coarse aggregate sample**
  - ✓ Sample size
  - ✓ Sample quartering
- **Analysis of aggregate impact value data.**
  - ✓ aggregate impact value test procedures
  - ✓ Calculate aggregate impact value
- **Reporting aggregate impact value test results**
  - ✓ Identification of reports elements
  - ✓ Elaboration of test report

Resources required for the learning outcome	
Equipment	▪ Testing machine, cylindrical steel cup, metal hammer, cylindrical metal,

	rounded tamping rod, balance, PPE
Materials	▪ Samples, papers, marker pens, pens, pencils, books, flip chat, white board, black board, chalks.
Tools	▪ Scoop, tamping rod, pan , calculator
Facilitation techniques	▪ Brainstorming, demonstration and simulation, individual and group work, practical exercise, Individualized, trainer guided and group discussion, Four steps
Formative assessment methods /(CAT)	▪ Written assessment, oral presentation, performance assessment, Project based assessment

Learning outcome 5: Perform Los Angeles test	**Learning hours: 15**

Indicative content

- **Identification of Los Angeles standard test methods**
  - ✓ Definitions of terms used for Los Angeles abrasion test
  - ✓ Applicable standards
  - ✓ Purpose of Los Angeles abrasion test
  - ✓ Applications of Los Angeles abrasion test
- **Selection of tools, materials and equipment**
  - ✓ Classes of tools
  - ✓ Classes of equipment
  - ✓ Types of material
- **Sampling of coarse aggregate material**
  - ✓ Techniques of sampling
  - ✓ Characteristics of sample
- **Preparation of coarse aggregate sample**
  - ✓ Sample size
  - ✓ Sample quartering
- **Analysis of Los Angeles value data.**
  - ✓ Los Angeles abrasion test procedures
  - ✓ Calculate Los Angeles abrasion value
- **Reporting Los Angeles abrasion test results**
  - ✓ Identification of report elements
  - ✓ Elaboration of test report

Resources required for the learning outcome	
Equipment	▪ Balance, sieves, sieve shaker, oven, Los Angeles abrasion machine, projector, computer, PPE
Materials	▪ Samples, papers, marker pens, pens, pencils, books, flip chat, white board, black board, chalks.
Tools	▪ Scoop, brush, pan, steel charges, metal tray, calculator
Facilitation techniques	▪ Brainstorming, demonstration and simulation, individual and group work, practical exercise, Individualized, trainer guided and group discussion, Four steps
Formative assessment methods /(CAT)	▪ Written assessment, oral presentation, performance assessment, Project based assessment

Learning outcome 6: Perform coarse aggregate water absorption test	**Learning hours: 15**

Indicative content

- **Identification of water absorption standard test methods**
  - ✓ Definition of terms used for water absorption test
  - ✓ Applicable standards
  - ✓ Purpose of water absorption test
  - ✓ Applications of water absorption test
- **Selection of tools, materials and equipment**
  - ✓ Classes of tools
  - ✓ Classes of equipment
  - ✓ Types of material
- **Sampling of coarse aggregate material**
  - ✓ Techniques of sampling
  - ✓ Characteristics of sample
- **Preparation of coarse aggregate sample**
  - ✓ Sample size
  - ✓ Sample quartering
- **Analysis of water absorption result.**
  - ✓ water absorption test procedures
  - ✓ Calculate water absorption value

- **Reporting aggregate water absorption test results**
  - ✓ Identification of reports elements
  - ✓ Elaboration of test report

Resources required for the learning outcome	
Equipment	Wire Mesh Bucket, projector, computer, soaking tank, oven, wiper, balance, PPE
Materials	Samples, papers, marker pens, pens, pencils, books, flip chat, white board, black board, chalks and water.
Tools	Pan, calculator.
Facilitation techniques	Brainstorming, demonstration and simulation, individual and group work, practical exercise, Individualized, trainer guided and group discussion
Formative assessment methods /(CAT)	Written assessment, oral presentation, performance assessment, Project based assessment

Integrated/Summative assessment

Integrated situation

In Rulindo District, Shyorongi Sector, there is a project of constructing a rigid pavement of 10 km. XGR Construction Ltd offered a tender of supplying coarse aggregate and fine sand that will be used in that project. BYG ltd won the tender. As a laboratory technician of the contractor's company, you are requested to perform:

Los Angeles abrasion test, flakiness index & elongation test, aggregate crushing value, aggregates impact value test and coarse aggregate water absorption test to analyse the quality of those coarse aggregates and perform sand equivalent test to analyse the quality of the fine sand, to determine the quantity of clay and silt in sand. This task should be done within 7 hours. All specifications are provided in the tender documents. All materials, tools and equipment needed are in LAB

Resources

Tools	Standard, scooper, pan, sieves, ruler, timer, barrel brush, calculator, papers, report sheet, pens, abrasion charges
Equipment	Sand shaker machine, balance, Los Angeles machine, sieve shaker machine, Wire Mesh Bucket, soaking tank, oven, wiper, mould, measuring cylinder, plunger, steel cylinder, base plate, tamping rod, compression machine, Thickness gauge, length gauges. Graduated plastic cylinder, rubber stopper, irrigator tube, weighted foot assembly, and siphon assembly, glass or plastic container with cover, siphon, discharge tube,
Materials/ Consumables	Coarse aggregate, Fine aggregate, Water, Calcium chloride solution, distilled or deionized water

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
1. **Perform sand equivalent test** **(20%)**	Standard test method is properly identified according to the material to be tested.	Standard test method is identified			1
	Tools and equipment are properly selected in accordance with type of work	Tools are selected			1
		Equipment is selected			1
	Fine aggregates are correctly sampled in reference with the standard.	Fine aggregate materials are sampled			2

	Fine aggregates are properly prepared in reference with the standard.	Fine aggregate are prepared			1
	Sand equivalent test procedure is properly performed in accordance with the standards	Clay level is indicated			2
		Sand level is indicated			2
	Sand equivalent test data are correctly analyzed in accordance with the recorded data.	Sand equivalent value is analysed			1
	Sand equivalent test results are properly reported in accordance with the standard.	Sand equivalent test is reported			1
		All reports elements are identified			2
2. **Perform Flakiness Index And Elongation Test** **(15%)**	Standard test method is properly identified according to the material to be tested.	Standard test method is identified			1
	Tools and equipment are properly selected in reference with the standard.	Tools are selected			1
		Equipment is selected			1
	Coarse aggregates sample are correctly sampled in reference with the standard	Coarse aggregate sample are sampled			2
	Coarse aggregates are properly prepared in reference with the standard.	Coarse aggregate are prepared			2
	Flakiness index and elongation test procedure is properly performed in accordance with the standards	Flakiness index is calculated			2
		Elongation index is calculated			2
	Flakiness index and elongation test data are correctly analyzed in accordance with the recorded	Flakiness index and elongation			2

	data.	test data are analyzed			
	Flakiness index and elongation value test results are properly reported in accordance with the standard.	Flakiness index and elongation value test results are reported			2
3. **Perform Aggregate Crushing Value Test** **(15%)**	Standard test method is properly identified according to the material to be tested.	Standard test method is identified			1
	Tools and equipment are properly selected in reference with the standard.	Tools are selected			2
		Equipment is selected			2
	Coarse aggregates sample are correctly sampled in reference with the standard	Coarse aggregate sample are sampled			2
	Coarse aggregates are properly prepared in reference with the standard.	Coarse aggregate are prepared			1
	Aggregate crushing value test procedure is properly performed in accordance with the standards	Weight of total sample is indicated			2
		Ratio of weight fines to total weight is calculated			2
	Aggregate crushing value test data are correctly analyzed in accordance with the recorded data.	Aggregate crushing value data are analysed			1
	Aggregate crushing value test results are properly reported in accordance with the standard.	Aggregate crushing value are reported			2
4. **Perform Aggregates Impact Value Test** **(15%)**	Standard test method is properly identified according to the material to be tested.	Standard test method is properly identified			1
	Tools and equipment are properly selected in reference with the standard.	Tools are selected			2
		Equipment is selected			2

	Coarse aggregates sample are correctly sampled in reference with the standard.	coarse aggregate sample are correctly sampled			2
	Coarse aggregates are properly prepared in reference with the standard.	coarse aggregate is prepared			2
	Aggregates impact value test procedure is properly performed in accordance with the standards	Net weight of the aggregates is determined			2
		Test sample is placed in the compaction machine			2
		Aggregate impact value is calculated			2
	Aggregates impact value test of coarse aggregates are correctly analyzed in accordance with the standard.	Aggregates impact value results are analyzed			2
		All tools and equipment are cleaned			2
	Aggregates impact value test results are properly reported in accordance with the standard.	Aggregates impact value test results are reported			2
5. **Perform Los Angeles Test** **(20%)**	Standard test method is properly identified according to the material to be tested.	Standard test method is identified			2
	Tools and equipment are properly selected in reference with the standard.	Tools are selected			1
		Equipment is selected			1
	Coarse aggregates sample are correctly sampled in reference with the standard.	coarse aggregate sample are correctly sampled			1
	Coarse aggregates are properly prepared in reference with the standard.	Coarse aggregate are prepared			1
	Los Angeles abrasion test procedure is properly	Aggregates crushing is			2

	performed in accordance with the standards	performed			
		Aggregate sieving is performed			2
		Mass of aggregates retained on the sieve is measured			2
		Mass of aggregates lost is calculated			2
		LAV is calculated			2
	Los Angeles abrasion test data are correctly analyzed in accordance with the recorded data.	Los Angeles abrasion Test data are analyzed			3
	Los Angeles abrasion test data test results are properly reported in accordance with the standard.	Los Angeles abrasion test data test results are reported			3
6. **Perform Coarse Aggregate Water Absorption Test** **(15%)**	Standard test method is properly identified according to the material to be tested.	Standard test method is identified			1
	Tools and equipment are properly selected in reference with the standard.	Tools are selected			1
		Equipment is selected			1
	Coarse aggregates sample are correctly sampled in reference with the standard.	coarse aggregate sample are sampled			2
	Coarse aggregates are properly prepared in reference with the standard.	coarse aggregate are prepared			2
	Water absorption test procedure is properly performed in accordance with the standards	Basket and aggregate samples are suspended in water			2
		Basket and aggregate samples are weighed			2

		Aggregate samples are heated			2
		Weight of saturated aggregates in air is determined			2
		Weight of oven dry aggregates in air is determined			2
	Water absorption test data are correctly analysed in accordance with the recorded data.	Water absorption data are analyzed			2
	Water absorption test data test results are properly reported in accordance with the standard.	Water absorption results are reported			2
Total marks					100
Percentage Weightage					100%
Minimum Passing line % (Aggregate):					70%

References

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