Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

BDCSB301

PRODUCTION OF SOIL BASED BRICKS AND BLOCKS

PRODUCE SOIL BASED BRICKS AND BLOCKS

Competence

RQF Level: 3

Learning Hours 50

Credits: 5

Sector: Construction and Building Services

Trade: Building construction

Module Type: Specific

Curriculum: CBSBDC3001- TVET Certificate 3 in Building Construction

Issue Date: October ,2021

1200

<table>
<tr><td>Purpose statement</td><td colspan="6">This is a core module which describes the skills, knowledge and attitudes to be acquired by the learner to produce good soil- based bricks/blocks. The learner should prepare the materials, making good mix, molding and burn soil-based brick /blocks in order to produce bricks or blocks of good quality. The learner deemed competent to this module may work in construction materials production under minimum supervision.</td></tr>
<tr><td>Learning assumed to be in place</td><td colspan="6">Safety, Health and environment at workplace, Construction basic technical drawing, Building Set out, Fundamentals of building materials</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 project and presentation</td><td>20%</td></tr>
<tr><td>• Individual project /Work</td><td>50%</td></tr>
<tr><td colspan="2"></td><td colspan="3">Summative Assessment</td><td>50%</td></tr>
</table>

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. Prepare materials, tools and Equipment.	1.1. Appropriate selection of PPE according to the works
	1.2. Correct selection of tools and equipment according to the mixing method.
	1.3. Proper selection of the raw materials according to the standard requirements of desired brick or block
	1.4. Ingredients for brick/ blocks making are properly prepared to avoid any foreign matter according to the work requirements.
2. Mix ingredient	2.1. Apply accurate batching of ingredients according to standard ratio
	2.2. Ingredients are methodically mixed to meet standard requirements of the desired construction material
	2.3. Equipment and tools are correctly set and properly operated in accordance with

	manufacturer's instructions.
3. Moulding bricks/blocks	3.1. Proper pouring into mould and pressing is carefully achieved according to manufacturers' instructions.
	3.2. De-molding fresh bricks/blocks is carefully done to avoid any damage
	3.3. Density, strength and surface texture of bricks/block is critically assessed in accordance with standard measurements of designed brick/ block
	3.4. Drying is properly done to avoid any damage
4. Construct kiln	4.1. Types of kilns are properly identified
	4.2. Kiln site is properly selected according to the requirements.
	4.3. Efficient construction of the kiln according to the desired type
5. Burn the bricks	5.1. Dried bricks are properly stacked in the kiln according the type of the kiln.
	5.2. Burning materials are properly prepared according to the requirements of the environmental management system standard.
	5.3. The kiln is properly fired according to the requirements of the environmental management system standard.
	5.4. The firing process is regularly monitored according to the quality requirements.
6. Perform Cooling	6.1. The cooling of burnt bricks is properly done according to the standard. 6.2. The Cooled bricks are safely evacuated and tested for quality. 6.3. Bricks are finally dumped in open-a-Air for Storage purpose.

Course content

Learning outcomes	**At the end of the module the learner will be able to:** **1. Prepare materials, tools and equipment** **2. Mix ingredient** **3. Mould bricks/blocks** **4. Construct kiln** **5. Burn the bricks** **6. Perform Cooling**
Learning outcome 1: **prepare materials, tools and equipment**	**Learning hours: 5**

Indicative content

- **Identification of tools**
    - The use of tools
    - The maintenance of tools
- **Identification of equipment**
    - PPE
    - Use of equipment
- **Description of raw materials used to make soil-based bricks or blocks.**
    - Mineral materials
    - Organic material
- **Use of materials**
    - Mineral materials
    - Organic material
- **Identification of Ingredients for adobe blocks**
- **Quality and properties of adobe blocks ingredients**
- **Identification of Ingredients for hydraform blocks**
- **Quality and properties of hydraform blocks ingredient**
- **Identification of Ingredients for burnt bricks/blocks**
- **Quality and properties of burnt bricks / blocks ingredients**
- **Method of quantiying Ingredients for soil based block and brick making.**
    - Volumetric method
    - By area method

Resources required for the learning outcome	
Equipment	Manual extruder machine, Motorized extruder machine, Electrical extruder

	machine, Crusher machine, Mixer machine, Brick making production chaine RS 175: Wheelbarrow specifications, ISO 19711-1: Building construction machinery and Equipment-Truck mixers-part 1: terminologies and commercial specifications, RS EAS 1021: Steelhead hammer-specifications, RS EAS 1020: Shovels and spades specifications, RS ISO 3310-1: Test Sieves-Technical requirements and testing
Materials	Natural clay mineral, Kaolin, Sand, Cement, Water, Soil, Coffee husks, Wood, Fuel, Peat, Sow dust, Rice husks (Rice hulls), RS EAS 54: Burnt building bricks — Specification, RS EAS 94: Burnt clay building blocks — Specification RS484: Adobe block (Rukarakara)— Specification, RS 310: Burnt clay paving units-Specification, RS ISO 14688-1 Geotechnical investigation and testing-Identification and classification of soil-Part 1: Identification and description , RS ISO 14688-2 Geotechnical investigation and testing- Identification and classification of soil-Part 2: Principles for a classification, Wheelbarrow
Tools	Spade, Hoes, Pick axe, Bucket, Machette, Wooden box, Claw hammer, Dumper
Facilitation techniques	• Group discussion • Trainer guided • Matching questions • Multiple choice • Sentence completion • Short questions • Essay • Open ended questions
Formative assessment methods	• Written assessment • Performance assessment

Learning outcome 2: **Mix ingredients**	**Learning hours: 5**

Indicative content

- **Methodes of batching**
  - By volume
  - By weighting
- **Requirements of good mixing**
- **Proportion Methods of ingredients mixing**
  - Manual method
  - Mechanical method
- **Preparation of mixing batch.**
  - Methods of batching
  - Standards of mixing ratio : RS 108 mortar for masonry – specification.

➢ Calibration of instruments • **Quantification of mixing ingredients** ➢ Ingredients of making cement mortar for blocks and pavers ➢ Measuring method • **Use mixing mortar method.** ➢ Types of Mortar ➢ Method of mixing mortar	
Resources required for the indicative content	
Equipment	Manual extruder machine, Motorized extruder machine, Electrical extruder machine, Crusher machine, Mixer machine, Brick making production chaine RS 175: Wheelbarrow specifications, ISO 19711-1: Building construction machinery and Equipment-Truck mixers-part 1: terminologies and commercial specifications, RS EAS 1021: Steelhead hammer-specifications, RS EAS 1020: Shovels and spades specifications, RS ISO 3310-1: Test Sieves-Technical requirements and testing
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Tools	Spade, Hoes, Pick axe, Bucket, Machette, Wooden box, Claw hammer, Dumper
Facilitation techniques	• Group discussion • Trainer guided • Matching questions • Multiple choice • Sentence completion • Short questions • Essay • Open ended questions
Formative assessment methods	• Written assessment • Performance assessment • Product based assessment

Learning outcome 3: Mould bricks and blocks	Learning hours: 15
Indicative content	
• **Process of pouring soil-based brick and block** • **Methods of compacting soil-based brick and block** • **Process of de-molding soil-based brick and block** • **Identification of soil-based brick and block properties** • **Identification of soil-based brick and block quality** • **Identification of drying methods for soil-based brick and block** ➢ Arttificial drying method ➢ Natural drying method • **Requirements of drying place for soil-based brick and block**	
Resources required for the indicative content	
Equipment	Manual extruder machine, Motorized extruder machine, Electrical extruder machine, Crusher machine, Mixer machine, Brick making production chaine RS 175: Wheelbarrow specifications, ISO 19711-1: Building construction machinery and Equipment-Truck mixers-part 1: terminologies and commercial specifications, RS EAS 1021: Steelhead hammer-specifications, RS EAS 1020: Shovels and spades specifications, RS ISO 3310-1: Test Sieves-Technical requirements and testing
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Tools	Spade, Hoes, Pick axe, Bucket, Machette, Wooden box, Claw hammer, Dumper
Facilitation techniques	• Lectures • Demonstration and simulation • Individual and group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	• Written assessment • Performance assessment

<table>
<tr><td></td><td>Product based assessment
Project based assessment</td></tr>
<tr><td colspan="2">Learning outcome 4: Construct Kiln   Learning hours: 15</td></tr>
<tr><td colspan="2">Indicative content</td></tr>
<tr><td colspan="2">
Description of kilns
Identification of types of kilns
Function and operation of kilns
Factors gorvening site selection
Envirnomental management system requirements
Curing of fabricated cement pavers.
Selection of site for kiln construction
Identification of construction materials
Requirements of construction materials
Identification of kiln parts
Erect foundation
Erect walls and chimney
Roofing
</td></tr>
<tr><td colspan="2">Resources required for the indicative content</td></tr>
<tr><td>Equipment</td><td>Manual extruder machine, Motorized extruder machine, Electrical extruder machine, Crusher machine, Mixer machine, Brick making production chaine
RS 175: Wheelbarrow specifications, ISO 19711-1: Building construction machinery and Equipment-Truck mixers-part 1: terminologies and commercial specifications, RS EAS 1021: Steelhead hammer-specifications, RS EAS 1020: Shovels and spades specifications, RS ISO 3310-1: Test Sieves-Technical requirements and testing</td></tr>
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RS484: Adobe block (Rukarakara)— Specification, RS 310: Burnt clay paving units-Specification, RS ISO 14688-1 Geotechnical investigation and testing-Identification and classification of soil-Part 1: Identification and description , RS ISO 14688-2 Geotechnical investigation and testing- Identification and classification of soil-Part 2: Principles for a classification, Wheelbarrow</td></tr>
<tr><td>Tools</td><td>Spade, Hoes, Pick axe, Bucket, Machette, Wooden box, Claw hammer, Dumper</td></tr>
<tr><td>Facilitation techniques</td><td>Lectures
Demonstration and simulation
Individual and group work
Practical exercise
Individualized
Trainer guided
Group discussion</td></tr>
</table>

Formative assessment methods	• Written assessment • Performance assessment • Product based assessment • Project based assessment

Learning outcome 5: **Burn bricks**	**Learning hours: 5**
Indicative content	
• **Identification of methods of stacking bricks** ➢ Manual method ➢ Mechanical method • **Identification of stacking patterns:** ➢ Zig-zag pattern ➢ Rat trap pattern ➢ Jack-on- jack pattern • **Safe procedures of bricks stacking** • **Identification of materials for bricks/ blocks burning** • **Properties of bricks/ blocks burning materials** • **Stages of firing dry bricks** • **Identification of required temperature for bricks/blocks burning** • **Identification of proper time/ period for burning bricks according to the type of kiln** • **Measuring the kiln temperature.**	
Resources required for the indicative content	
Equipment	Manual extruder machine, Motorized extruder machine, Electrical extruder machine, Crusher machine, Mixer machine, Brick making production chaine RS 175: Wheelbarrow specifications, ISO 19711-1: Building construction machinery and Equipment-Truck mixers-part 1: terminologies and commercial specifications, RS EAS 1021: Steelhead hammer-specifications, RS EAS 1020: Shovels and spades specifications, RS ISO 3310-1: Test Sieves-Technical requirements and testing
Materials	Natural clay mineral, Kaolin, Sand, Cement, Water, Soil, Coffee husks, Wood, Fuel, Peat, Sow dust, Rice husks (Rice hulls), RS EAS 54: Burnt building bricks — Specification, RS EAS 94: Burnt clay building blocks — Specification RS484: Adobe block (Rukarakara)— Specification, RS 310: Burnt clay paving units-Specification, RS ISO 14688-1 Geotechnical investigation and testing-Identification and classification of soil-Part 1: Identification and description , RS ISO 14688-2 Geotechnical investigation and testing- Identification and classification of soil-Part 2: Principles for a classification, Wheelbarrow
Tools	Spade, Hoes, Pick axe, Bucket, Machette, Wooden box, Claw hammer, Dumper

Facilitation techniques	• Group discussion • Trainer guided • Matching questions • Multiple choice • Sentence completion • Short questions • Essay • Open ended questions
Formative assessment methods	• Written assessment • Performance assessment • Product based assessment

Learning outcome 6: **perform cooling of bricks/blocks**	**Learning hours: 5**
Indicative content	
• **Methods of cooling burnt bricks** ➢ Natural method ➢ Artificial method • **Procedures of safe evacuation of bricks/blocks from the kiln** • **Identification of burnt bricks tests for quality** • **Types of storage** ➢ Internal storage ➢ External storage • **Requirements of good storage for burnt bricks/blocks:**	
Resources required for the indicative content	
Equipment	Manual extruder machine, Motorized extruder machine, Electrical extruder machine, Crusher machine, Mixer machine, Brick making production chaine RS 175: Wheelbarrow specifications, ISO 19711-1: Building construction machinery and Equipment-Truck mixers-part 1: terminologies and commercial specifications, RS EAS 1021: Steelhead hammer-specifications, RS EAS 1020: Shovels and spades specifications, RS ISO 3310-1: Test Sieves-Technical requirements and testing
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Tools	Spade, Hoes, Pick axe, Bucket, Machette, Wooden box, Claw hammer, Dumper
Facilitation techniques	• Group discussion • Trainer guided • Matching questions • Multiple choice • Sentence completion • Short questions • Essay • Open ended questions
Formative assessment methods	• Written assessment • Performance assessment • Product based assessment

Integrated/Summative assessment (For specific module)

Integrated situation

NE private co. Ltd is a company located in Rusizi district Nyakarenzo sector, Kakuyu village dealing with food-based products manufacturing. This company is facing financial problems related to high overheads expenses mainly lental expenses. After conducting financial assessment, the consultant advised the company to build their own house to cut lental expenses in future. Therefore, this company has hired a contractor to construct a house in burnt bricks. The selected contractor while he was collecting all needed materials to accomplish the work, have realized that there is burnt bricks shortage on market and available quality was not meeting contract specifications. Consequently, contactor decided to produce the required number of burnt bricks, hydraform blocks and adobe blocks for the foresaid works so that he may control the delivery rate and quality. The company has already produced samples of needed burnt brick, adobe block and hydraform block types. The company is willing to recruit a mason who will produce the required number of burnt brick, adobe block and hydraform blocks. As one of the candidates who is competing to this position, you are requested to demonstrate the following:

1. Identify and used correctly safety equipment
2. Select and describe the quality of clay to be used

3. Prepare the working place
4. Put in place environmental protective measures
5. Calculate the quantity of clay needed to mould the requested number of bricks
6. Mix the clay according to standard
7. Mould the requested bricks according to standard
8. Dry the moulded green brick according to standard
9. Burnt the requested bricks according to the standard

10. Store the requested bricks according to standard
11. Stack the requested bricks according to the standard

Given that:

12. Required tools, material and equipment are on site.
13. Kiln is in place
14. Firing temperature is 8000c
15. Needed burnt brick size is: 5.5*10*21 (cm)
16. Needed adobe blocks size :20*20*40 (cm)
17. Needed hydraform blocks size :20*20*40 (cm)

Resources

Equipment	Manual extruder machine, Motorized extruder machine, Electrical extruder machine, Crusher machine, Mixer machine, Brick making production chaine RS 175: Wheelbarrow specifications, ISO 19711-1: Building construction machinery and Equipment-Truck mixers-part 1: terminologies and commercial specifications, RS EAS 1021: Steelhead hammer-specifications, RS EAS 1020: Shovels and spades specifications, RS ISO 3310-1: Test Sieves-Technical requirements and testing
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Tools	Spade, Hoes, Pick axe, Bucket, Machette, Wooden box, Claw hammer, Dumper

Assessable	Assessment criteria (Based on	Indicator	Observation	Marks

outcomes	performance criteria)		Yes	No	allocation
Learning outcome 1: 1. **Prepare materials, tools and Equipment (10%)**	1.1. Appropriate tools are selected according to the work to be performed.	Tools are selected			3
	1.2. Correct selection of tools and equipment according to the mixing method.	Equipment is selected			3
	1.3. Proper selection of the raw materials according to the standard requirements of desired brick or block	Materials are selected			2
	1.4 Ingredients for brick/ blocks making are properly prepared to avoid any foreign matter according to the work requirements.	Ingredients are prepared			2
Learning outcome 2: **Mix ingredients** **(10%)**	2.1. Apply accurate batching of ingredients according to standard ratio	Ingredients are batched			4
	2.2. Ingredients are methodically mixed to meet standard requirements of the desired construction material	Ingredients are mixed			3
	2.3. Equipment and tools are correctly set and properly operated in accordance with manufacturer's instructions.	Equipment and tools are settled			3
Learning outcome 3: **Mould bricks / blocks** **(30%)**	3.1. Proper pouring into mould and pressing is carefully achieved according to manufacturers' instructions.	pouring into mould and pressing is achieved			7
	3.2 De-molding fresh bricks/blocks is carefully done to avoid any damage	De-molding fresh bricks/blocks is done.			8
	3.3. Density, strength and surface texture of bricks/block is critically assessed in accordance with standard measurements of designed brick/ block	Density, strength and surface texture of bricks/block is assessed.			7
	3.4. Drying is properly done to avoid any damage	Drying is done without any damage			8
Learning outcome 4: **Construct kiln (20%)**	4.1. Types of kilns are properly identified	Types of kilns are identified			7
	4.2. Kiln site is properly selected according to the requirements.	Kiln site is properly selected			6
	4.3. Efficient construction of the kiln according to the desired type	the kiln is constructed			7
Learning outcome 5: **Burn the bricks (20%)**	5.1. Dried bricks are properly stacked in the kiln according the type of the kiln.	Dried bricks are stacked in the kiln.			5
	5.2. Burning materials are properly prepared according to the requirements of the environmental management	Burning materials are prepared			5

	system standard.				
	5.3. The kiln is properly fired according to the requirements of the environmental management system standard.	The kiln is fired.			5
	5.4. The firing process is regularly monitored according to the quality requirements.	The firing is regularly monitored			5
Learning outcome 6: Perform Cooling (10%)	6.1. The cooling of burnt bricks is properly done according to the standard.	The cooling of burnt bricks is done			3
	6.2. The Cooled bricks are safely evacuated and tested for quality.	The Cooled bricks are evacuated and tested for quality.			3
	6.3. Bricks are finally dumped in open-a-Air for Storage purpose.	Bricks are dumped in open-a-Air.			4
Total marks					**100**
Percentage Weightage					**100%**
Minimum Passing line % (Aggregate): 70%					

References:

1. Davey N and Ashton LA (1953). *Investigation of building Fires. Part V. Fire tests on structural elements*, National Building Studies No. 12, HMSO, London.

2. De Vekey RC (1993). Cavity walls – Still a good solution, BMS proc.M(S), 35-38S

3. de VekeyRC (2001) brick block and masonry mode from aggregate concrete: part2-aPPEarance and environmentental aspect, BREdigest460, part2

4. Construction standards, *burnt clay building blocks* — specification; RS EAS 94: 1999