



Republic of Rwanda
Ministry of Education



RTB | RWANDA
TVET BOARD

CONSTRUCTION OF STONES STRUCTURES

BDCSS301

CONSTRUCT STONES STRUCTURES

Competence

RQF Level: 3

Learning Hours



Credits: 7

Sector: Construction and Building Services

Trade: Building construction

Module Type: Specific

Curriculum: CBSBDC3001- TVET Certificate 3 in Building Construction

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Purpose statement	This Core module describes the skills, knowledge and attitude required to construct stone structures which includes foundations, walls, stairs, water tanks, open channels, dams and inspection chambers. At the end of this module, the student will be able to set out trenches, set out of different stone structures, erect any type of stone structures and checking the quality of finished stone structure according to Rwandan Standard.					
Leaning assumed to be in place	Safety, Health and environment at workplace; Construction basic technical drawing; Building Set out; Fundamentals of building materials					
Delivery modality	Training delivery	100%	Assessment	Total 100%		
	Theoretical content	30%	Formative assessment	30%		
	Practical work:	70%		70%	50%	
	• Group project and presentation					20%
	• Individual project /Work					50%
	Summative Assessment		50%			

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. Prepare materials, tools and equipment	1.1. Right PPE is selected according to the safety and security measures
	1.2. Tools and equipment are adequately selected according to the work to be done.
	1.3. Materials are identified according to the required quality.
2. Prepare the construction site	2.1. Construction site is cleaned by removing trees, bushes and other hazardous objects
	2.2. Adequately excavate and level the construction area with respect to the desired structure
	2.3. Map out accurately the foundation in accordance with design dimensions
	2.4. The trenches are dug efficiently with respect to the marked dimensions
3. Prepare mortar	3.1. Ingredients for mortar mix are appropriately selected.

	3.2. Mix ratio and method of mixing are correctly applied in accordance with Rwanda Standards requirements and design considerations
	3.3. Mixing mortar is carried out at the convenient place
4. Erect stone structures	4.1. Types of stone structures are identified properly
	4.2. Stones are well selected according to their qualities and its use
	4.3. Stones are shaped with respect to standard shapes, size and its use.
	4.4. Stone water reservoirs and open channels are constructed with respect to the given shape, water holding capacity and applicable standard requirements.
	4.5. Foundation and stairs are erected efficiently accordance with structure design and applicable standard.
	4.6. Retaining walls are erected with respect to the structural design and applicable standard.
	4.7. Stone water tanks are constructed according to the designed shape, water holding capacity and applicable standard.
	4.8. Stone finishes are applied on erected stone structure.
5. Clean the workplace	5.1. Tools and equipment are correctly cleaned by respecting cleaning method.
	5.1. Adequate cleaning of working area
	5.1. Appropriate storage of tools and equipment by respecting storage method.

Course content

Learning outcomes	At the end of the module the learner will be able to: <ol style="list-style-type: none"> 1. Prepare materials, tools and equipment 2. Prepare the construction site 3. Mix mortar 4. Erect stone structures 5. Clean the workplace
Learning outcome 1: prepare materials, tools and equipment	Learning hours: 5
Indicative content	
<ul style="list-style-type: none"> • Identification of tools used to construct stones <ul style="list-style-type: none"> ➤ Tools used to construct stones ➤ Uses of tools ➤ Maintenance of tools • Identification of equipment <ul style="list-style-type: none"> ➤ Equipment used to construct stones ➤ Uses of equipment ➤ Maintenance of equipment • Identification of materials used to construct stone masonry complying with Rwanda Standards 	
Resources required for the learning outcome	
Equipment	RS ISO 13688: Protective clothing — General requirements, RS ISO 20347: Personal protective equipment — Occupational footwear, RS ARS 1697: Personal protective equipment — Face shield — Specification, RS ISO/TR 2801: Clothing for protection against heat and flame — General recommendations for selection, care and use of protective clothing, ISO 21420: Protective gloves-General requirements and test methods, RS ISO 4007: Personal protective equipment — Eye and face protection — Vocabulary, ISO 3873: industrial safety helmet.
Materials	Cement, Fine aggregate, Coarse aggregate, Water, Stone, Bricks, Internet, handouts, RS 107 : Building sand from natural sources — Specification, RS ARS 1304 : Guidelines for use of various types of cement, RS EAS 18-1 : Cements — Part 1 : Composition, specification and conformity criteria for common cements.
Tools	Trowel, Spirit level, Squares, Building line, Tape measure, Wheelbarrow, Roller brush, Hand brush, Scrapper, Tray , Steel float, Sand paper, Pan/bucket, Extension pole, Mixing stick, Strings (Road marking line), Brushes, Paint Scrapper, Roller, Roller tray and Bucket/pan
Facilitation techniques	<ul style="list-style-type: none"> • Group discussion

	<ul style="list-style-type: none"> • Trainer guided • Matching questions • Multiple choice • Sentence completion • Short questions • Essay • Open ended questions • Practical exercises
Formative assessment methods	<ul style="list-style-type: none"> • Written assessment • Performance assessment

Learning outcome 2: Prepare the construction site	Learning hours: 5
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Indicative content

- **Cleaning of Construction site.**
 - Removing of any unwanted elements on working area
- **Excavation and levelling the Construction Site**
 - Method of excavation
 - Levelling working area:
- **Setting of signs Mark out foundation outlines**
 - Procedure of mark out foundation outlines
- **Dig out Foundation trenches**
 - Digging out trenches methods
 - Timbering of trenches

Resources required for the indicative content

Equipment	RS ISO 13688: Protective clothing — General requirements, RS ISO 20347: Personal protective equipment — Occupational footwear, RS ARS 1697: Personal protective equipment — Face shield — Specification, RS ISO/TR 2801: Clothing for protection against heat and flame — General recommendations for selection, care and use of protective clothing, ISO 21420: Protective gloves-General requirements and test methods, RS ISO 4007: Personal protective equipment — Eye and face protection — Vocabulary, ISO 3873: industrial safety helmet.
Materials	Cement, Fine aggregate, Coarse aggregate, Water, Stone, Bricks, Internet, handouts, RS 107: Building sand from natural sources — Specification, RS ARS 1304 : Guidelines for use of various types of cement, RS EAS 18-1 : Cements — Part 1 : Composition, specification and conformity criteria for common cements.

Tools	Trowel, Spirit level, Squares, Building line, Tape measure, Wheelbarrow, Roller brush, Hand brush, Scrapper, Tray , Steel float, Sand paper, Pan/bucket, Extension pole, Mixing stick, Strings (Road marking line), Brushes, Paint Scrapper, Roller, Roller tray and Bucket/pan
Facilitation techniques	<ul style="list-style-type: none"> • Group discussion • Trainer guided • Matching questions • Multiple choice • Practical exercises • Short questions • Essay • Open ended questions
Formative assessment methods	<ul style="list-style-type: none"> • Written assessment • Performance assessment • Product based assessment

Learning outcome 3: Prepare Mortar	Learning hours: 5
Indicative content	
<ul style="list-style-type: none"> • Selection of mortar Ingredients <ul style="list-style-type: none"> ➤ Ingredients for making mortar complying with Rwanda Standards ➤ Acceptable quality of ingredients Complying with Rwanda Standard • Application of mixing ratio and Mixing method <ul style="list-style-type: none"> ➤ Identification of Mix Ratio ➤ Description of Mixing Method • Quantification of mixing ingredients <ul style="list-style-type: none"> ➤ Ingredients for mortar ➤ Quantification method • Application of mixing mortar method <ul style="list-style-type: none"> ➤ Types of Mortar with reference from Rwanda Standards ➤ Mortar mixing tips ➤ function of various ingredients of mortar ➤ Properties of good mortar ➤ Method of mixing mortar 	
Resources required for the indicative content	
Equipment	RS ISO 13688: Protective clothing — General requirements, RS ISO 20347: Personal protective equipment — Occupational footwear, RS ARS 1697: Personal protective equipment — Face shield — Specification, RS ISO/TR 2801: Clothing for protection

	against heat and flame — General recommendations for selection, care and use of protective clothing, ISO 21420: Protective gloves-General requirements and test methods, RS ISO 4007: Personal protective equipment — Eye and face protection — Vocabulary, ISO 3873: industrial safety helmet.
Materials	Cement, Fine aggregate, Coarse aggregate, Water, Stone, Bricks, Internet, handouts, RS 107: Building sand from natural sources — Specification, RS ARS 1304 : Guidelines for use of various types of cement, RS EAS 18-1 : Cements — Part 1 : Composition, specification and conformity criteria for common cements.
Tools	Trowel, Spirit level, Squares, Building line, Tape measure, Wheelbarrow, Roller brush, Hand brush, Scrapper, Tray , Steel float, Sand paper, Pan/bucket, Extension pole, Mixing stick, Strings (Road marking line), Brushes, Paint Scrapper, Roller, Roller tray and Bucket/pan
Facilitation techniques	<ul style="list-style-type: none"> • Demonstration and simulation • Individual and group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	<ul style="list-style-type: none"> • Written assessment • Performance assessment • Product based assessment • Project based assessment

Learning outcome 4: Erect stone structures	Learning hours: 50
Indicative content	
<ul style="list-style-type: none"> • Identification of types of stone structures <ul style="list-style-type: none"> ➤ Identification of types of stone structures ➤ Various sizes, shapes of stone structures • Selection of types of stone of good quality <ul style="list-style-type: none"> ➤ Identification of Stone qualities by Complying with Rwanda Standards ➤ Selection of Stone to be used • Shaping and cutting the stone to be used <ul style="list-style-type: none"> ➤ Various types and sizes of stones. ➤ Various shapes of stones. • Construction of stone water reservoirs and open channels structures <ul style="list-style-type: none"> ➤ Identification of water holding capacity ➤ Types of water reservoir ➤ Types of Open channels shapes ➤ Types of stone bonds • Erection of foundation and stairs 	

- Description of foundation
- Description of stair
- Calculation of stair
- **Erection of retaining walls structures**
 - Types of retaining wall
 - Function of retaining wall
 - Erect retaining wall with structural Rwanda standard
- **Construction of stone water tank structure**
 - Identification of standardized water tank shapes
 - Mention of water holding capacity
 - Description of construction Methods with respect to the compliance of Rwanda Standards
- **Application of finishes on erected stone structure.**
 - Preparation of stone finishes complying with Rwanda Standards
 - Types of stone structure finishes
 - Identification of construction methods

Resources required for the indicative content

Equipment	RS ISO 13688: Protective clothing — General requirements, RS ISO 20347: Personal protective equipment — Occupational footwear, RS ARS 1697: Personal protective equipment — Face shield — Specification, RS ISO/TR 2801: Clothing for protection against heat and flame — General recommendations for selection, care and use of protective clothing, ISO 21420: Protective gloves-General requirements and test methods, RS ISO 4007: Personal protective equipment — Eye and face protection — Vocabulary, ISO 3873: industrial safety helmet.
Materials	Cement, Fine aggregate, Coarse aggregate, Water, Stone, Bricks, Internet, handouts, RS 107: Building sand from natural sources — Specification, RS ARS 1304: Guidelines for use of various types of cement, RS EAS 18-1: Cements — Part 1 : Composition, specification and conformity criteria for common cements.
Tools	Trowel, Spirit level, Squares, Building line, Tape measure, Wheelbarrow, Roller brush, Hand brush, Scrapper, Tray , Steel float, Sand paper, Pan/bucket, Extension pole, Mixing stick, Strings (Road marking line), Brushes, Paint Scrapper, Roller, Roller tray and Bucket/pan
Facilitation techniques	<ul style="list-style-type: none"> ● Demonstration and simulation ● Individual and group work ● Practical exercise ● Individualized ● Trainer guided ● Group discussion
Formative assessment methods	<ul style="list-style-type: none"> ● Written assessment ● Performance assessment

- Product based assessment
- Project based assessment

Learning outcome 5: Conduct Cleanup activities

Learning hours: 5

Indicative content

- **Cleaning tools and equipment**
 - Identification of tools and equipment to be cleaned
 - Mention methods of cleaning
- **Cleaning erected stone structure area**
 - Identification of tools and equipment to be cleaned
 - Methods of cleaning
- **Storage of tools, materials and equipment.**
 - Identification of storage of tools, Materials and equipment's location
 - Proper handling and storage methods

Resources required for the indicative content

Equipment	RS ISO 13688: Protective clothing — General requirements, RS ISO 20347: Personal protective equipment — Occupational footwear, RS ARS 1697: Personal protective equipment — Face shield — Specification, RS ISO/TR 2801: Clothing for protection against heat and flame — General recommendations for selection, care and use of protective clothing, ISO 21420: Protective gloves-General requirements and test methods, RS ISO 4007: Personal protective equipment — Eye and face protection — Vocabulary, ISO 3873: industrial safety helmet.
Materials	Cement, Fine aggregate, Coarse aggregate, Water, Stone, Bricks, Internet, handouts, RS 107: Building sand from natural sources — Specification, RS ARS 1304: Guidelines for use of various types of cement, RS EAS 18-1: Cements — Part 1 : Composition, specification and conformity criteria for common cements.
Tools	Trowel, Spirit level, Squares, Building line, Tape measure, Wheelbarrow, Roller brush, Hand brush, Scrapper, Tray , Steel float, Sand paper, Pan/bucket, Extension pole, Mixing stick, Strings (Road marking line), Brushes, Paint Scrapper, Roller, Roller tray and Bucket/pan
Facilitation techniques	<ul style="list-style-type: none"> • Lectures • Demonstration and simulation • Individual and group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment	<ul style="list-style-type: none"> • Written assessment

methods	<ul style="list-style-type: none"> • Performance assessment • Product based assessment • Project based assessment
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Integrated/Summative assessment (For specific module)

Integrated situation

MUHABURA INTEGRATED POLYTECHNIC COLLEGE (MIPC) is a College Located in Northern Province, Musanze District. MIPC surrounded by fence of 110 m long, this fence is facing a problem of landside which may later destroy some building of the MIPC. The Management of MIPC has decided to sign a Contract with SJAP Company Ltd to protect against the above said landslide starting from the front side of Main Public Road by Stepped Stone Retaining wall of 60 m long, 2m height and 0.5 m thick. As a Mason from Contracted Company, you are requested to erect the foresaid retaining wall of 2.5m long within 7 Hours. MIPC is requested to use well Shaped Stone for Ashlar Masonry Bond. Given That:

- a. All materials tools and equipment are available on site
- b. Drawings are provided
- c. Blinding Concrete is Poured and hardened in the bottom base of the trench.
- d. The gradient slope to be applied during the Execution of Stepped Stone Retaining Wall is 90% as Shown on the Drawings.

Resources

Tools	Wood floater, Steel floater, Tape measure, Spirit level, Spades, Steel squares, Trowel, Notch trowel, Steel ruler, Hammer, Scraper, Straight edge, Mason's line, Mortar pan, Stones, Dampy level, Calibrated Gauge Box, Wheelbarrow
Equipment	PPE, concrete mixer
Materials/ Consumables	Sand, Cement, Water, Lime, Lime, Nails

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
Learning outcome 1: 1. Prepare materials, tools and equipment (10%)	1.1. Right PPE is selected according to the safety and security measures	PPE is properly selected			4
	1.2. Tools and equipment are adequately selected according to the work to be Done.	Tools and equipment are adequately selected			3
	1.3. Materials are identified according to the required quality.	Materials are properly selected			3
Learning	2.1. Construction site is cleaned by	Construction site is cleaned			2

outcome 2: Prepare the construction site (10%)	removing trees, bushes and other hazardous objects				
	2.2 Adequately excavate and level the construction area with respect to the desired structure	Excavation is adequately done			2
	2.3. Map out accurately the foundation in accordance with design dimensions	Foundation is accurately map out			3
	2.4. The trenches are dug efficiently with respect to the marked dimensions	trenches are dogged with respect to the marked dimensions			3
Learning outcome 3: Mix mortar (10%)	3.1. Ingredients for mortar mix are appropriately selected.	Ingredients are appropriately selected			3
	3.2. Mix ratio and method of mixing are correctly applied in accordance with Rwanda Standards requirements and design considerations.	Ingredients for mortar mix are appropriately selected			3
	3.3. Mixing mortar is carried out at the convenient place	Mixing mortar is carried out at the convenient place			4
Learning outcome 4: Erect stone structures (60%)	4.1. Types of stone structures are identified properly	Types of stone structures are identified			5
	4.2. Stones are well selected according to their qualities and its use.	Stones are selected			5
	4.3. Stones are shaped with respect to standard shapes, size and its use.	Stones are shaped with respect to standard shapes ,size and its use			7
	4.4. Stone water reservoirs and open channels are constructed with respect to the given shape, water holding capacity and applicable standard requirements.	Stone water reservoirs and open channels are constructed with respect of shape and water holding capacity			8
	4.5. Foundation and stairs are erected efficiently accordance with structure design and applicable standard.	Foundation and stairs are erected with respect of structure design and applicable standard			7
	4.6. Retaining walls are erected with respect to the structural design and applicable standard.	Retaining walls are erected with respect to the structural design and applicable standard.			8
	4.7. Stone water tanks are constructed	Stone water tanks are			10

	according to the designed shape, water holding capacity and applicable standard.	constructed with respect of designed shape, water holding capacity and applicable standard			
	4.8. Stone finishes are applied on erected stone structure.	Stone finishes are applied on erected stone structure.			10
Learning outcome 5: Clean the workplace (10%)	5.1 Tools and equipment are correctly cleaned by respecting cleaning method.	Tools and equipment are correctly cleaned			3
	5.2 Adequate cleaning of working area	working area is cleaned			3
	5.3 Appropriate storage of tools and equipment by respecting storage method.	Tools and equipment are storage			4
Total marks					100
Percentage Weightage					100%
Minimum Passing line % (Aggregate): 70%					

References:

1. Rozz Algar W, "Technology and Engineering" ,2010, Routledge House
2. John Ashurst, "Conservation of Building and Decorative Stone Structure",2001, Taiwast House
3. T.F. Fwa," Highway Engineering ,2005, CRC Press
4. Atlantic Publishing Group, "Building with Rocks and Stone", 2010,
5. David Doran "Construction Materilas,2013, Routledge House
6. James Gage, "Guide to new England stone Structure", 2016, Powwow-River.