Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

NON-BITUMINOUS PAVEMENTS CONSTRUCTION

PWONP401

Construct non Bituminous Pavements

Competence

RQF Level: 4

Learning Hours



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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Purpose statement	This module describes the knowledge, skills, and attitudes required for the construction of non-bituminous pavement. It is intended for learners pursuing RQF level IV in Public Works. At the end of this module, learners will be able to perform preliminary works, construct rigid pavement, and construct cobble stone pavement.					
Learning assumed to be in place	Surveying data collection and setting out, Full soil identification and Insitu dry density test, Aggregates' Tests, Cement tests, Steel bar works, Concrete tests, Cement concrete works.					
Delivery modality	**Training delivery**		**100%**	**Assessment**		**Total 100%**
	Theoretical content		30%	Formative assessment	30%	50%
	Practical work:		70%		70%	
	• Group work and presentation	30%				
	• Individual work	40%				
			Summative Assessment			50%

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. Perform preliminary works	1.1. Activities are properly planned according to the work to be done
	1.2. Drawings and specifications are properly interpreted as per the works to be done
	1.3. Tools and Equipment is appropriately identified according to the work to be done
	1.4. Site survey is effectively conducted according to the work to be done
	1.5. Site survey results are properly reported as per specifications
2. Construct rigid pavement	2.1. Materials are properly selected according to the work to be done
	2.2. Tools and Equipment is properly selected according to the work to be done
	2.3. Subgrade is properly prepared according to the specifications
	2.4. Subbase layer is properly constructed according to the specifications
	2.5. Base layer is properly prepared according to the specifications
	2.6. Unreinforced concrete pavement is properly constructed according to the specifications

	2.7. Reinforced concrete pavement is properly constructed according to the specifications
	2.8. Working site is effectively cleaned as per environmental requirements
3. Construct cobble stone pavement	3.1. Materials are properly selected according to the work to be done
	3.2. Tools and Equipment is properly selected according to the work to be done
	3.3. Subgrade is properly prepared according to the specifications
	3.4. Sub base layer is properly constructed according to the specifications
	3.5. Stone dressing is effectively performed according to the specifications
	3.6. Stone laying is effectively performed according to the design and specifications
	3.7. Working site is effectively cleaned as per environmental requirements

Intended Knowledge, Skills, and Attitude

Knowledge	Skills	Attitude
✓ Identify non-bituminous pavement materials ✓ Describe characteristics of good concrete ✓ Explain basic knowledge of surveying technics ✓ Determine quantities of materials required ✓ Recognize technical standards ✓ Maintain Health and Safety ✓ Explain fresh concrete casting procedure ✓ Explain Curing process	✓ Interpret technical drawing ✓ Use surveying instruments ✓ Set out pavement ✓ Communicate at workplace ✓ Perform concrete batching ✓ Perform concrete mixing ✓ Perform concrete pouring procedures ✓ Cure the concrete work ✓ Lay stones ✓ Apply ICT in reporting ✓ Report work done	✓ Use creativity and innovation throughout the work execution ✓ Pay attention to use surveying instruments ✓ Communicate actively at workplace ✓ Be punctual in performing works ✓ Be dynamic during the work ✓ Demonstrate good leadership in managing the site

Course content

Learning outcomes	At the end of the module the learner will be able to: 1. Perform preliminary works 2. construct rigid pavement 3. construct cobble stone
Learning outcome 1: Perform preliminary works	**Learning hours: 20hrs**

Indicative content

- Planning of activities
  - ✓ Interpretation of work schedule
  - ✓ Identification of activities
  - ✓ Identification of resources
  - ✓ Elaboration of activities chart
- **Interpretation of drawing and specifications**
  - ✓ Layout view
  - ✓ Cross section
  - ✓ Longitudinal profile
  - ✓ Materials specifications
- **Identification of tools and equipment**
  - ✓ Categories of tools and equipment
  - ✓ Selection of tools and equipment
- **Conducting site survey**
  - ✓ Identification of site boundaries
  - ✓ Identification of source of electricity and water supply
  - ✓ Identification of site accessibility
  - ✓ Identification of source of construction materials
  - ✓ Identification of site installation
- **Reporting site survey results**

- ✓ Elements of report
- ✓ Elaborating site survey report

Resources required for the learning outcome	
Equipment	Computer, Projector, Printer, GPS, Camera.
Materials	Paper, Internet, Notebook, Book, Ink, Wood.
Tools	Pen, Pencils, Marker, Whiteboard, Duster, Hoe, Metallic bucket, Pickaxe, Machette, Axe
Facilitation techniques	Brainstorming, practical exercise, trainer guided and group discussion.
Formative assessment methods /(CAT)	Written assessment, oral presentation, Project based assessment, individual and group work

Learning outcome 2: Construct rigid pavement	**Learning hours: 40hrs**

Indicative content

- **Selection of rigid pavement materials**
  - ✓ Description of rigid pavement
    - Definition of rigid pavement
    - Types of rigid pavement
    - Advantages and disadvantages of rigid pavement
  - ✓ Subgrade materials
    - Types of subgrade materials
    - Properties of subgrade materials
  - ✓ Subbase materials
    - Types of subbase materials
    - Properties of subbase materials
  - ✓ Base course materials
    - Types of base course materials
    - Properties of base course materials

- ✓ Wearing course materials
  - Identification of wearing course materials
  - Properties of wearing course materials

- **Selection of tools and equipment**
  - ✓ Categories of tools used on road layer construction
  - ✓ Categories of equipment used on road layer construction
  - ✓ Selection criteria of tools and equipment
  - ✓ Maintenance of tools and equipment
- **Preparation of subgrade**
  - ✓ Procedure of preparation of subgrade
  - ✓ Preparing existing soil
    - Replace soil.
    - Performing soil improvement.
    - Perform rock fill for stabilization.
    - Drain subsurface water.
- **Construction of subbase layer**
  - ✓ Requirements of subbase materials
  - ✓ Construction procedures
- **Construction of unreinforced concrete pavement**
  - ✓ Types of unreinforced concrete pavement
  - ✓ Preparation of the concrete casting area
    - Cleaning
    - Formwork
  - ✓ Batching of materials
    - Batching by volume
    - Batching by weight
  - ✓ Mixing of materials
    - Mixing ratio
    - Methods of mixing
  - ✓ Transportation and pouring of concrete mixture
    - Transportation modes

- Pouring methods
- Vibration of Concrete

✓ Curing of concrete pavement

- Importance of curing
- Methods of concrete curing

- **Construction of reinforced concrete pavement**

✓ Types of reinforced concrete pavement

✓ Difference between RCC and prestressed concrete

✓ Preparation of the concrete casting area

- Cleaning
- Formwork
- Steel reinforcement works

✓ Batching of materials

- Batching by volume
- Batching by weight

✓ Mixing of materials

- Mixing ratio
- Methods of mixing

✓ Transportation and pouring of concrete mixture

- Transportation modes
- Pouring methods
- Vibration of Concrete

✓ Curing of concrete pavement

- Importance of curing
- Methods of concrete curing

✓ Concrete finishing

- **Clean working site**

✓ Importance of clean workplace

✓ Methods of cleaning workplace

Resources required for the learning outcome

Equipment	PPE, Levelling instruments, Concrete truck, Trucks, Air compressor Spraying machine, Motor grader, Compactors, Excavator, Wheel loader Backhoe, Dumper, Concrete mixer, Concrete vibrator, Concrete pump, Stone crusher machine, Bull dozer, Water tank.
Materials	Timber, Paints, Water, Paraffin, Burner, Aggregates, Quarry Dust, Stones, Laterite/Murram, Cement, Sand, Nails, Pegs, Warning tape, Marker pen, Geotextile, Pipes, Wire Mesh.
Tools	Rulers, Spade, Shovel, Hoe, Pickaxe, Machete, Axe, Trowels, Spirit level Hammers, Squares, Brooms, Bucket /Basin, Asphalt metallic pan, Metallic bucket, Wheelbarrow.
Facilitation techniques	Lectures, Brainstorming, individual and group work, practical exercise, trainer guided and group discussion.
Formative assessment methods /(CAT)	Written assessment, oral presentation, Project based assessment.

Learning outcome 3: Construct cobble stone pavement	**Learning hours: 30hrs**

Indicative content

- **Selection of cobble stone pavement materials**
  - ✓ Description of cobble stone pavement
    - Definition of cobble stone pavement
    - Types of cobble stone pavement
    - Advantages and disadvantages of cobble stone pavement
  - ✓ Subgrade materials
    - Types of subgrade materials
    - Properties of subgrade materials
  - ✓ Subbase materials
    - Types of subbase materials
    - Properties of subbase materials
  - ✓ Wearing course materials
    - Identification of wearing course materials
    - Properties of wearing course materials
- **Selection of tools and equipment**
  - ✓ Categories of tools
  - ✓ Categories of equipment
  - ✓ Selection criteria of tools and equipment

- ✓ Maintenance of tools and equipment

- **Preparation of subgrade**
  - ✓ Procedure of preparation of subgrade
  - ✓ Preparing existing soil
- **Construction of subbase layer**
  - ✓ Methods of compaction
  - ✓ Construction procedures
- **Performing stone dressing**
  - ✓ Purpose of stone dressing
  - ✓ Stages of stone dressing
  - ✓ Methods of stone dressing
- **Performing stone laying**
  - ✓ Construction of kerb lines
  - ✓ Sand screeding
  - ✓ Stone placement
- **Cleaning of working site**
  - ✓ Importance of clean workplace
  - ✓ Methods of cleaning workplace
  - ✓ Storing tools and equipment

Resources required for the learning outcome	
Equipment	PPE, Levelling instruments, Trucks, Low bed, Compactors/tamper, Excavator, Wheel loader, Backhoe, Dumper, Stone crusher machine.
Materials	Timber, Paints, Water, Paraffin, Burner, Aggregates, Quarry Dust, Stones, Laterite/Murram, Cement, Sand, Nails, Pegs, Warning tape, Marker pen, Geotextile, Pipes, Wire Mesh, Mortar.
Tools	Rulers, Spade, Shovel, Hoe, Pickaxe, Machete, Axe, Trowels, Spirit level Hammers, Squares, Brooms, Bucket /Basin, Metallic bucket, Wheelbarrow, Folding rule, water level.
Facilitation techniques	Brainstorming, individual and group work, practical exercise, trainer guided and group discussion.
Formative assessment methods /(CAT)	Written assessment, oral presentation, performance assessment, project-based assessment.

Integrated situation

Amahoro village located in Kayonza District has a problem of a slippery roadway during the rainy season. In collaboration with the District of Kayonza, Amahoro village has gained a fund to construct a 3 km long carriageway. As a non-bituminous technician of MLA Company Ltd that won a contract to do the above mentioned works, you are requested to construct a carriageway with a wearing coarse in reinforced concrete of 4m length and 3 m width and a walkway in cobblestone of 3m length and 1 m width. The work includes preparing the subgrade, construction of the subbase, and wearing course within 5 days including 5 hours of presentation to the assessors on how each layer has been constructed. Note that the thickness of each layer is indicated on the drawing, and the mixing ratio should achieve strength target.

All materials, tools, and Equipment is available on the site.

Resources

Tools	Rulers,Spade,Shovel,Hoe,Pickaxe,Machete,Axe,Trowels,Spiritlevel Hammers, Squares, Brooms, Bucket /Basin, Metallic bucket, Wheelbarrow, Chisel.
Equipment	PPE, Levelling instruments, Concrete truck, Trucks,Aircompressor, Spraying machine, Motor grader, Compactors, Excavator, Wheel loader, Backhoe, Dumper, Concrete mixer, Concrete vibrator, Concrete pump, Stone crusher machine, Bull dozer, Water tank.
Materials/ Consumables	Timber,Paints,Water,Paraffin,Burner,Aggregates,QuarryDust,Stones,Laterite/Murram,Cement, Sand, Nails, Additive, Pegs, Warning tape, Marker pen, Geotextile, Pipes, Wire Mesh, Steel bars,etc…

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
1. Preliminary works (20%)	Activities are properly planned according to the work to be done	Working schedule are interpreted			2
		Activities are identified			2
	Drawings and	Drawings and specifications are			2

	specifications are properly interpreted as per the works to be done	interpreted			
		Longitudinal profile is interpreted			2
	Tools and Equipment is appropriately identified according to the work to be done	Tools are selected			2
		Equipment is selected			2
	Site survey is effectively conducted according to the work to be done	Site boundaries are identified			2
		Site accessibility are Identified			2
	Site survey results are properly reported as per specifications	Element of report are elaborated			2
		survey report are properly elaborated			2
2. Construct rigid pavement (40%)	Materials are properly selected according to the work to be done	Subgrade materials are selected			3
		Subbase materials are selected			3
		Wearing course materials are selected			3
	Tools and Equipment is properly selected according to the work to be done	Tools are selected			2
		Equipment is selected			2
	Subgrade is properly prepared according to the specifications	Bushes, trees and top soil are removed			2
		Subgrade materials are compacted			2

		Subgrade layer is levelled			2
	Subbase layer is properly constructed according to the specifications	Construction procedures are followed			2
		Correct method of compaction is chosen			2
	Reinforced concrete pavement is properly constructed according to the specifications	Formwork is installed and checked			3
		Steel bars are installed			2
		Batching of material is done			2
		Mixing of materials is done			2
		Transportation and pouring of concrete mixture is done			2
		Curing of materials is done			3
3. Construct cobble stone (40%)	Materials are properly selected according to the work to be done	Subgrade materials are selected			2
		Subbase materials are selected			2
		Wearing course materials are selected			2
	Tools and Equipment is properly selected according to the work to be done	Tools are properly selected			2
		Equipment is selected			2
	Subgrade is properly	Bushes, trees and top soil			2

	prepared according to the specifications	are removed			
		Subgrade preparation procedures are followed			2
		Subgrade layer is levelled			2
	Sub base layer is properly constructed according to the specifications	Subbase construction procedures are followed			2
		Correct method of compaction is chosen			2
	Stone dressing is effectively performed according to the specifications	Stage of dressing stone are followed			3
		Process of dressing stone are well followed			3
	Stone laying is effectively performed according to the design and specifications	Kerb lines are properly constructed			3
		Process of laying stone are followed			3
		Stone laying is correctly compacted			3
	Working site is effectively cleaned as per environmental requirements	Tools used are cleaned			2
		Equipment used are cleaned			2
		Workplace used are cleaned			2
		Time is respected			1
Total marks					
Percentage Weightage					100%
Minimum Passing line % (Aggregate):					70%

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