Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

PWORA301

ROAD ALIGNMENT SETTING

SET ROAD ALIGNMENT

Competence

RQF Level: 3

Learning Hours: 40

Credits: 4

Sector: Construction and Building Services

Trade: Public Works

Module Type: Specific

Curriculum: CBSPWO3001TVET Certificate III in Public Works

Issue Date: May 2022

<table>
<tr><td>Purpose statement</td><td colspan="5">This module describes the skills, knowledge and attitude required to set road alignment. It is intended for learners who want to pursue the level 3 in public works. At the end of this module the trainees will be able to prepare for work, define levels and demarcate road profiles. Qualified learners deemed competent to this competency shall have ability to take responsibility for the carrying out of a range of basic defined activities in setting out the road alignment under non- directive supervision.</td></tr>
<tr><td>Leaning assumed to be in place</td><td colspan="5">Safety, Health and environment at workplace; Basic technical drawing; Public works resources.</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>60%</td></tr>
<tr><td>• Individual project /Work</td><td>40%</td></tr>
<tr><td colspan="3"></td><td colspan="2">Summative Assessment</td><td>50%</td></tr>
</table>

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. Prepare for field work	1.1. Topographic map is appropriately interpreted with reference to the topographic area
	1.2. Interpret road basic drawing with respect to the standard
	1.3. The working area is properly prepared with respect to the work
	1.4. Tools, instrument/equipment and materials are properly selected in relation to the work
	1.5. Safety measures are efficiently applied with respect to the work.
2. Set levels	2.1. Surveying instruments are accurately set as per setting techniques.
	2.2. Data for road alignment setting are precisely recorded in reference to the benchmark.
	2.3. Levels are adequately marked on pegs with reference to the recorded data.
3. Delineate road profiles	3.1. Road width is conveniently demarcated with respect to the drawing
	3.2. Horizontal profile is conveniently demarcated with respect to cross section elements
	3.3. Vertical profile is accurately demarcated with respect to road drawings

Course content

Learning outcomes	At the end of the module the learner will be able to: 1. Prepare for work 2. Set levels 3. Delineate road profiles
Learning outcome 1: Prepare for work	**Learning hours: 5**

Indicative content

(Based on the performance criteria and the extent of learning outcomes: what, up to, how):

- **Interpretation of Topographic map**
  - ✓ Elements of Topographic map
  - ✓ Use of topographic map
- **Interpretation of road basic drawings**
  - ✓ Road basic drawing
  - ✓ Interpretation of longitudinal profiles drawings
- **Preparation of the working area**
  - ✓ Method of clearing working area
  - ✓ Steps of preparing site
- **Selection of tools, instrument/equipment and materials** (Refer to RS 435; RS EAS 23; RS ISO 20347; RS 175; RS EAS 914; RS 409; RS EAS 132; RS EAS 1020)
  - ✓ Tools
  - ✓ Equipment/ Instrument
  - ✓ Materials
- **Application of safety measures**
  - ✓ Application of personal protective equipment
  - ✓ Safety consideration on environmental conditions at work

Resources required for the learning outcome

Equipment	GPS, DGPS, dumpy level, staff level, tripod, plumb bob, tape measure, helmet, reflector jacket, safety shoes, overall, umbrella, Total station.
Materials	Maps, drawings, pegs
Tools	Hoe, pang, spade, wheelbarrow, range rod , hammer
Facilitation techniques	• Lectures, demonstration and simulation, individual and group work, practical exercise, Individualized ,trainer guided and group discussion
Formative assessment	• Written assessment ,oral presentation ,performance assessment ,Project based

methods	assessment

Learning outcome 2: **Set levels**	**Learning hours: 15**

Indicative content

(Based on the performance criteria and the extent of learning outcomes: what, up to, how):

- **Setting instruments for levels**
  - ✓ Steps of setting surveying instruments
  - ✓ Adjustment of surveying instruments
- **Recording of data.**
  - ✓ The initial steps of data recording
  - ✓ Introduction to levelling key words
  - ✓ Staff reading
  - ✓ Calculations related to data recording
- **Marking of levels** (Refer to RS 435; RS EAS 23; RS ISO 20347; RS 175; RS EAS 914; RS 409; RS EAS 132; RS EAS 1020)
  - ✓ Set appropriate camber and longitudinal slope
  - ✓ Set vertical and horizontal curves
  - ✓ Set gradients
  - ✓ Initial steps for marking levels on pegs
    - Assemble of the recorded levels
    - Identification of the levels
      - Level offset with plus sign
      - Level offset with minus sign
  - ✓ Types of level marking on pegs
    - Mark levels with a plus sign
    - Mark levels with minus sign
  - ✓ Chainage offset

Resources required for the indicative content

Equipment	GPS, dumpy level, staff level, tripod, plumb bob, tape measure, helmet, reflector jacket, safety shoes, overall, umbrella
Materials	Maps, drawings, pegs
Tools	Hoe, pang, spade, wheelbarrow, range rod, hammer
Facilitation techniques	• Lectures, demonstration, simulation, individual and group work, practical exercise, individualized, trainer guided, group discussion

Formative assessment methods	• Written assessment, oral presentation, performance assessment, project-based assessment

Learning outcome 3: Delineate road profiles	**Learning hours: 20**
Indicative content	
(Based on the performance criteria and the extent of learning outcomes: what, up to, how): • **Demarcation of road width** (Refer to RS 435; RS EAS 23; RS ISO 20347; RS 175; RS EAS 914; RS 409; RS EAS 132; RS EAS 1020) ✓ Elements of road width ✓ Procedures of road width demarcation ✓ Elements of carriageway ✓ Procedures of carriageway demarcation • **Demarcation of horizontal profile** ✓ Horizontal alignment ✓ Cross-section • **Demarcation of vertical profile** ✓ Vertical alignment ✓ Vertical curves	
Resources required for the indicative content	
Equipment	GPS, dumpy level, staff level, tripod, plumb bob, tape measure, helmet, reflector jacket, safety shoes, overall, umbrella.
Materials	Maps, drawings, pegs
Tools	Hoe, pang, spade, wheelbarrow, range rod , hammer
Facilitation techniques	Lectures, demonstration, simulation, individual and group work, practical exercise, individualized, trainer guided, group discussion
Formative assessment methods	Written assessment, oral presentation, performance assessment, project-based assessment

Integrated/Summative assessment
Integrated situation

The district of Nyaruguru wants to construct a 20 km of unpaved road in Nyabimata sector to facilitate the population to reach their fields. Therefore, the District has signed a contract with NTBD Ltd company to perform the said works.

As a public works technician from the foresaid company you are required to set this road alignment on a section of 150m long. You have to accomplish this task within 8 hours.

In addition, the feeder road should have two lanes of 3m of width each.

- You are required to provide a walkway of 1m of width and a side ditch of 40 cm of depth and 50cm of width that should be provided on the whole length of the feeder road.
- You are required to make the chainage offset at each 10 m.
- You are required to set horizontal and vertical curves where necessary

All Resources: Tools, instruments/ equipment and materials are available on site.
All Contact facilities for public infrastructures are available

Equipment	GPS, dumpy level, staff level, tripod, plumb bob, tape measure, helmet, reflector jacket, safety shoes, overall, umbrella.
Materials/ Consumables	Maps, drawings, pegs
Tools	Hoe, pang, spade, wheelbarrow, range rod, hammer

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
Learning outcome 1: Prepare for work **(20%)**	1.1. Topographic map is appropriately interpreted with reference to the topographic area.	**Ind.1**. Elements of Topographic map are properly interpreted			3
		Ind.2. Use of topographic map is appropriately explained			3
	1.2.Road basic drawing properly interpreted with respect to the standard	**Ind.1** Road basic drawings are properly interpreted			5
		Ind.2 Horizontal profile drawings are properly interpreted			5
		Ind.3 Vertical profile drawings are properly interpreted			5
	1.3.Tools, instrument/equipment and materials are properly selected in relation to the work	**Ind.1** Tools are properly selected			1
		Ind.2 Equipment are properly selected			1
		Ind.3 Materials are properly selected			1

	1.4. Safety measures are efficiently applied with respect to the work.	**Ind.1** Personal protective equipment are appropriately applied			4
		Ind.2 Types of traffic signs on work are properly used			4
		Ind.3 Safety consideration on environmental conditions at work are properly checked			2
	1.5.The working area is properly prepared with respect to the work	**Ind.1** The working area is properly cleared			2
Learning outcome 2: Set levels **(40%)**	2.1.Instruments are accurately set as per setting techniques	**Ind.1** The main steps of setting a dumpy level are accurately set			6
		Ind.2 camber and longitudinal slope are accurately set			4
		Ind.3 Vertical and horizontal curves are precisely set			6
	2.2.Data are precisely recorded in reference to the benchmark	**Ind.1.**The initial steps of data recording are appropriately followed			2
		Ind.2 Staff reading are properly recorded			6
		Ind.3.Calculations related to data recording are well calculated			6
	2.3.Levels are adequately marked on pegs with reference to the recorded data	**Ind.1.** Initial steps for marking levels on pegs are properly followed			3
		Ind.2. Level marking on pegs are accurately marked			4
		Ind.3. Chainage offset is properly set			3
Learning outcome 3: Delineate road profiles **(40%)**	3.1.Road width is conveniently demarcated with respect to the drawing	**Ind.1.** Elements of road width are properly interpreted			2
		Ind.2. Procedures of road width demarcation are properly followed			1
		Ind.3 Road width is precisely demarcated			4
	3.2.Horizontal profile is conveniently demarcated with respect to cross section elements	**Ind.1** Horizontal alignment elements are precisely demarcated			5
		Ind.2. Cross-section elements are properly demarcated			4
		Ind.3 sight distance elements are			2

		precisely delineated			
	3.3.Vertical profile is accurately demarcated with respect to road drawings	**Ind.1.** Vertical alignment elements are accurately demarcated			5
		Ind.2. Vertical curves are precisely demarcated			2
		Ind.3. Sight distance element are properly delineated			2
		Ind.4. Time is well respected			1
Total marks					**100**
Percentage Weightage					**100%**
Minimum Passing line % (Aggregate):				**70%**	

References:

1. Daniel J. Findley, Bastian J. Schroeder, Christopher M. Cunningham, Thomas H. Brown, Jr - Highway engineering planning, design, and operations Elsevier_Butterworth Heinemann (2016)
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3. SANRAL Geometric Design Guideline-The Council for Scientific and Industrial Research (CSIR) in South Africa (2013)
4. A Policy on Geometric Design of Highways and Streets, 6th Edition AASHTO. Washington, D.C. 2011.
5. Traffic Engineering Handbook, 6th Edition Institute of Transportation Engineers. Washington, D.C. 2008.
6. Russell C. Brinker & Paul R. Wolf. Harper & Row. Elementary Surveying, 6th Edition New York. 1977.
7. Standard Roadway Drawings Tennessee Department of Transportation.
8. RS 435: Timber in joinery — General requirements,
9. RS EAS 23: Timber — Dimensions for coniferous sawn timber (cypress and pine) — Sizes of sawn and planed timber — Specification,
10. RS ISO 20347: Personal protective equipment — Occupational footwear; RS 175: wheelbarrow specifications;
11. RS EAS 914: Mild steel nails — Specification;
12. RS EAS 132: Hoe — Specification;
13. RS 409: School chalks — Specification;
14. RS EAS 132: Hoe — Specification;
15. RS EAS 1020: Shovels and spades — Specification
16. RS 435: Timber in joinery — General requirements,
17. RS EAS 23: Timber — Dimensions for coniferous sawn timber (cypress and pine) — Sizes of sawn and planed timber — Specification,
18. RS ISO 20347: Personal protective equipment — Occupational footwear;
19. RS 175: wheelbarrow specifications